SCIENTIFIC AMERICAN

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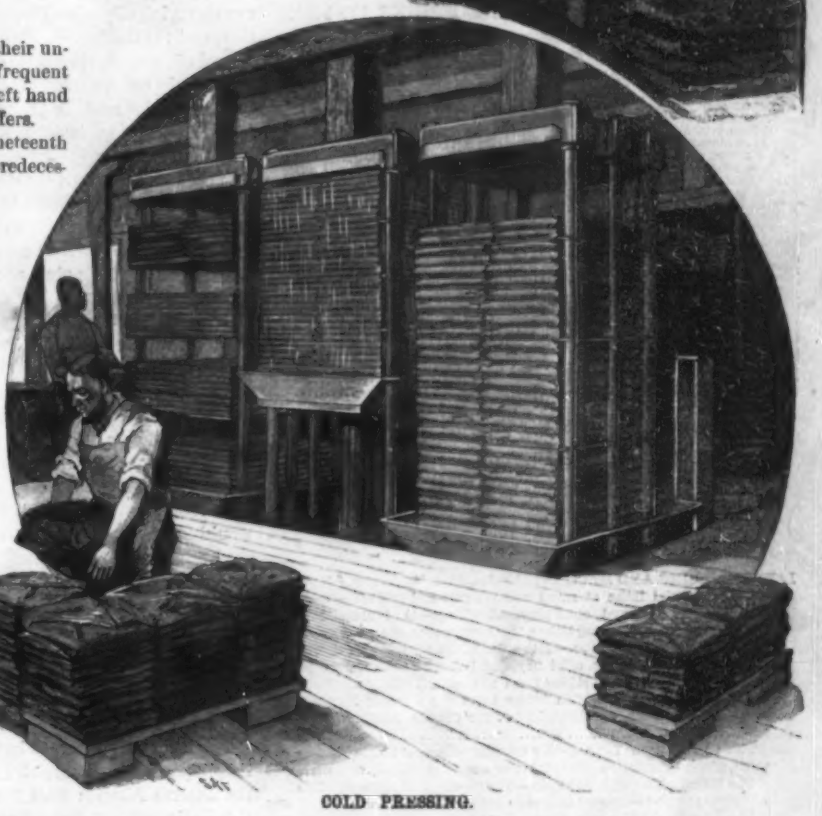
COOLING ROOM.

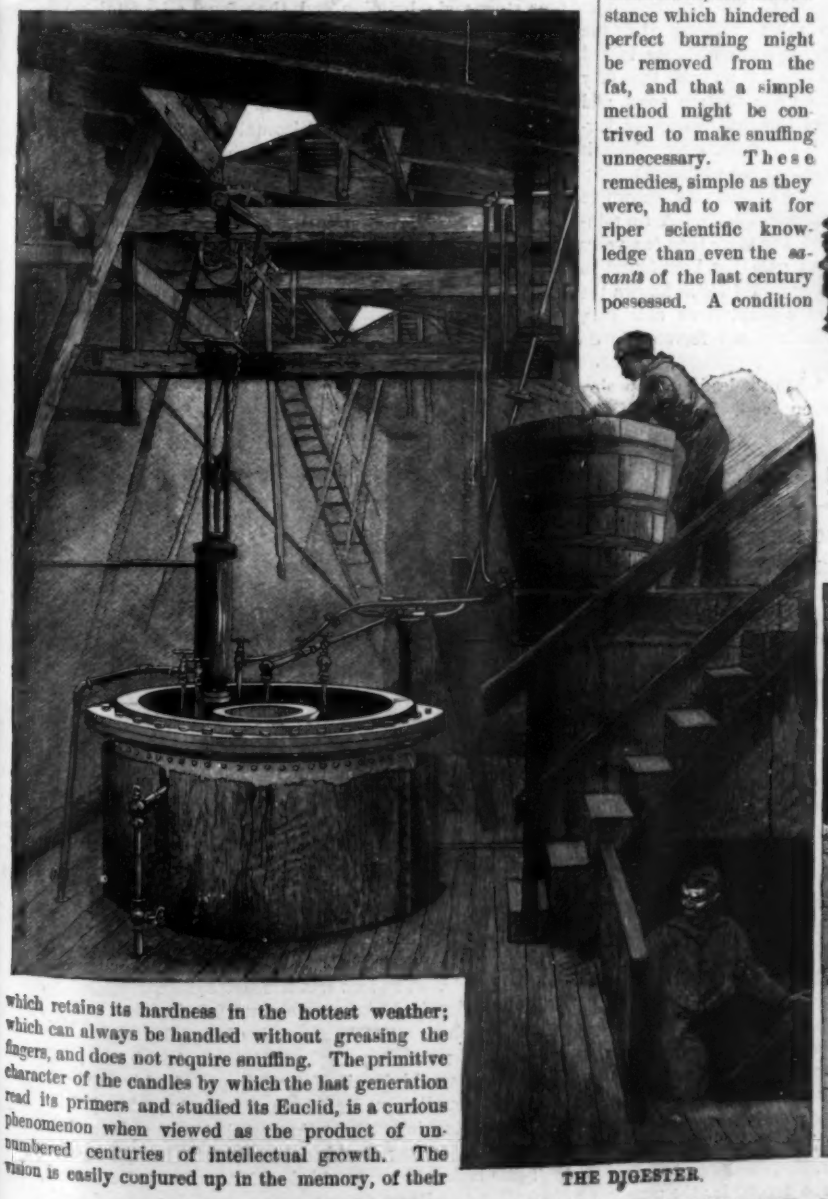
AMERICAN INDUSTRIES.—No. 79.

THE MANUFACTURE OF CANDLES.

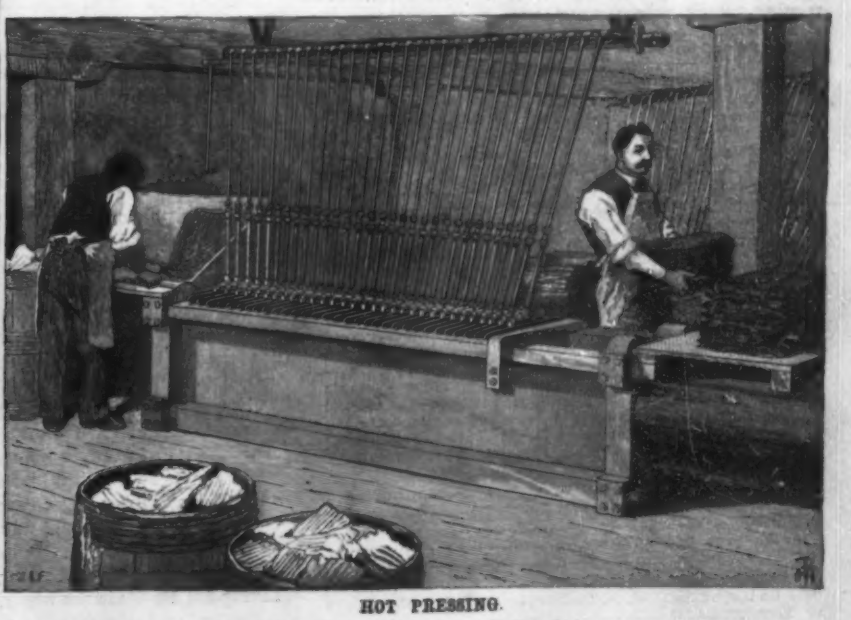
It is only the history of the modern candle that is written—the graceful, sightly, and tapering cylinder which burns with a clear white and brilliant light; that neither smokes nor "drips;"



COLD PRESSING.



THE DIGESTER.



HOT PRESSING.

HOW CANDLES ARE MADE.—MANUFACTORY OF PROCTER & GAMBLE, CINCINNATI, OHIO.

DIPPING CANDLES—THE OLD METHOD.

which retains its hardness in the hottest weather; which can always be handled without greasing the fingers, and does not require snuffing. The primitive character of the candles by which the last generation read its primers and studied its Euclid, is a curious phenomenon when viewed as the product of unnumbered centuries of intellectual growth. The vision is easily conjured up in the memory, of their yellow light, their smoke, their unpleasant odor, and their frequent need of attention from a deft hand and the old-fashioned snuffers.

One quarter of the nineteenth century had followed its predecessors before it occurred to man that tallow candles might be made hard enough to keep the year round without melting, that the smoke was caused by imperfect combustion, that the substance which hindered a perfect burning might be removed from the fat, and that a simple method might be contrived to make snuffing unnecessary. These remedies, simple as they were, had to wait for riper scientific knowledge than even the *savants* of the last century possessed. A condition precedent was a knowledge of the nature of fats and of that energetic display of chemical action which we now call combustion.

The progressive steps in candle-making from the age of the primeval savage up to the

[*Continued on page* 386.]

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 17, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 311,

For the Week ending December 17, 1881.

Price 10 cents. For sale by all newsdealers.

SOME GREAT ENGINEERING PROJECTS.

The shortening of commercial routes by means of ship railways and ship canals seems to be the great ambition of the engineers of to-day.

In addition to the De Lesseps Ship Canal at Panama, the Eads Ship Railway at Tehuantepec, the Florida Ship Canal, the Chesapeake and Delaware Ship Canal, the Cape Cod Canal, and others in the interior of this country, there are several other important projects of like nature under way or in prospect in various parts of the world. The old project of connecting the Bay of Fundy and Baie Verte, on the Gulf of St. Lawrence, across the Isthmus of Chignecto, has lately taken new form. It is now proposed to make the connection by a ship railway eighteen miles long, thus making a short cut for navigation between the United States and the ports on the St. Lawrence Gulf and River, and saving the long and dangerous voyage around Nova Scotia.

The projector of the ship railway, Mr. H. G. C. Ketchum, writes us that the plan grew out of a desire to save lockage and a deep channel in the design of the Baie Verte Canal. His first plan was to lift vessels by hydraulic power on pontoons and then float them through the canal. The idea then occurred that they might as well be lifted to the surface of the ground and hauled across the neck of land on rails. The road may be level and perfectly straight from end to end. The plan has been submitted to the Dominion Government and is favorably entertained. Mr. Ketchum has issued an interesting pamphlet relative to the project, which may be considered at greater length elsewhere.

Across the ocean the construction of the tunnel under the British Channel, connecting England with the Continent, is being prosecuted with an energy which is indicative of ultimate success, and thus far no obstacles have been encountered to make the undertaking a difficult or exceptionally hazardous one.

In France the connection of the Atlantic with the Mediterranean by a ship canal, to save the long and stormy voyage around the Spanish Peninsula, is under serious consideration, and the Council-General of the Seine have just adopted a resolution approving of the project.

The ship canal across the Isthmus of Corinth, in Greece, to shorten the route to Constantinople and the ports of the Black Sea, has, we believe, been definitely determined upon.

In the far East a bolder and more important project is in contemplation, with a view to shortening the commercial route to China and Japan by six hundred miles or more. At the head of the Malay Peninsula is the Isthmus of Kraw, connecting Upper with Lower Siam; and by the cutting of a ship canal at this point, about thirty miles in length, the need of sailing around the peninsula might be obviated. At Kraw, the Malayan Peninsula, which stretches southward for five hundred miles to Singapore, is at its narrowest breadth, and the distance across from the side of the Indian Ocean to that of the China Seas is further decreased by the existence of natural waterways for some distance inland from both shores. From side to side it is no more than fifty miles, and the Pakchan River, on the western coast, and the Htassay on the eastern, afford the ready means of further reducing it. The distance, therefore, over which it would be necessary to cut a canal would probably not exceed thirty miles. The neighboring districts are known to be fertile and to contain great mineral wealth. A tin mining company has been established for more than ten years at Malewon, on the Pakchan, and gold has been found in the neighboring stream of the Lenya. So far as known the engineering difficulties are not of a stupendous character, and political drawbacks and considerations fortunately do not exist.

The French appear to have taken the lead in proposing this important commercial short-cut, and, if the opinion of the London *Times* is well founded, the Government of British India will not decline to actively participate in its execution.

RAILROAD ACCIDENTS.

Railroad statistics show that there were an unusual number of accidents attended with fatal results on American railroads during the year ending October 31, 1881. They foot up 1,492 accidents, by which 397 persons were killed and 1,687 more were injured, being a monthly average of 124 accidents, 33 killed, and 141 injured.

The month of October, as reported by the *Railroad Gazette*, shows a greater number of accidents than the monthly average for the year, although the fatality was slightly less, the total for the month being 131 accidents, 31 persons killed, and 133 more injured. Of the October accidents, 51 were collisions, 77 derailments, 2 boiler explosions, and 1 fire. More than half the number of mishaps, where the time of day was reported, happened in the daytime, which appears to be remarkable, although it is said to be not an uncommon thing for more train accidents to occur in daylight than in the night time.

January took the lead in number of accidents, 223 having occurred in that month, while the greatest number of fatal casualties were in September, namely, 56 killed.

There were no less than four successful attempts at train wrecking in October. In one case obstructions were put on the track, in another a rail was removed, and in two more switches were misplaced. In only one case were the wreckers caught, and they are to be tried for murder, an engineer having lost his life in the wreck.

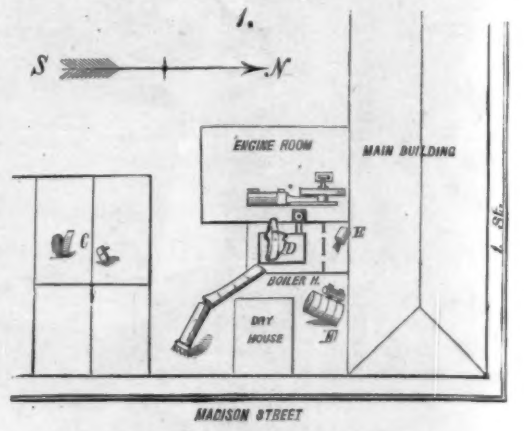
Six broken bridges are in the record for the month, an unusually large number. One of these had its abutments washed out, and in two other cases they were small wooden bridges.

TERRIBLE BOILER EXPLOSION IN OHIO.

The new Dayton Wheel Works, one of the finest manufactories of light vehicle wheels in this country, owned and occupied by Pinneo & Daniels, Dayton, Ohio, was, on October 25, the scene of a most astonishing and lamentable boiler explosion.

Three persons were killed, a number severely injured, and extensive damage was done to the works.

Henry Rokel, the only man in the fire-room at the time of the explosion, which took place at the noon hour, was blown into the fuel room and fatally mangled. Katie Makley, a girl of thirteen years of age, was killed by a flying brick while at play with her companions in St. Joseph's school-yard, a square away from the boiler house. A young man



Plan of Dayton Wheel Works.—(C, rear end of boiler. D, girdle of plates. E, front end of boiler. F, boiler No. 1.)

of seventeen years of age, named Mostbaum, was so badly injured that he died soon after the accident. He was eating his dinner in the yard. Peter Aplin, the engineer, formerly a railroad engineer, but in the employ of this firm since 1852, in their old works and their new, was in the engine room oiling his engine and preparing to start up the machinery. He was thrown among the ruins badly bruised and cut about the upper part of his body, but able to dig himself out. A number of others were injured. There were fifty or sixty workmen in the main building.

The plan of the works and the distribution of the parts of the broken boiler are shown in the diagram, Fig. 1. The four story main building and the wings, all of brick, are shown in Fig. 2. Other buildings, including a large dry-house, shown in the foreground of the diagram Fig. 1, are omitted from Fig. 2 for the sake of clearness of illustration.

The one story building (Fig. 2) in the angle was the boiler house, in which were two horizontal tubular boilers, 5 feet diameter by 16 feet long, each containing 46 flues, 4 inches

Dayton Wheel Works before explosion.

diameter, full length of the boiler. The steam drums, shown in Fig. 3, were 24 inches diameter by 7 feet long, upon which were attached the safety valves and steam connections, as shown. Each boiler had also a mud drum, 18 inches diameter by about 6 feet long, seen in Fig. 5.

The shells of these boilers had double riveted longitudinal seams, were new less than a year before the explosion, and originally had the appearance of being what they were intended by both makers and users to be—sample pieces of workmanship. The iron was five sixteenths charcoal brand, slightly under thickness, ranging from 0·29 inch to 0·30 inch, and said to have a tensile strength of 55,000 pounds to the square inch; meaning simply that a strip 1 inch wide, 0·29 inch thick, would break, if steadily pulled without shock, torsion, or bending, under a force of (55,000 × 0·29 =) 15,950 pounds acting in a direct line parallel to the plane of the strip, as in a testing machine, for example.

These boilers were provided with the usual attachments, including two steam gauges, one in the fire-room and one in

the engine room. They had, however, a common attachment to the boilers, not shown in the engravings. The water was fed into the front ends of the boilers and blown out from the rear end of the mud drums. There were two 4-inch safety valves, each having its own separate stand pipe communicating directly with the steam chamber of each boiler, as it properly should do.

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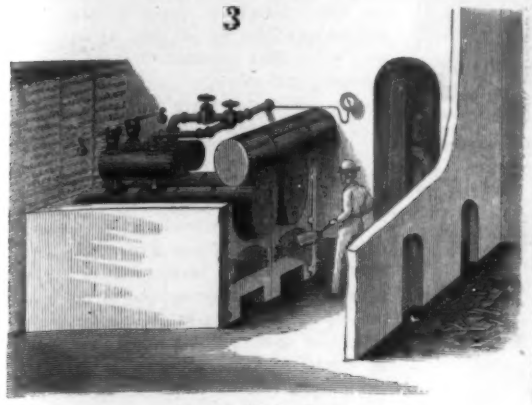

Interior of Boiler House.

The boilers were tested at a pressure of 140 pounds and put in operation about the beginning of 1881. The fuel used was chips, shavings, and refuse of hard dry timber from the factory, which was stored in the fireproof fuel room, shown at the right of Fig. 3. The steam was distributed at a supposed maximum pressure of 80 to 90 pounds through 6-inch main steam pipes to a 20-inch by 42-inch automatic cut-off engine running at 69 revolutions per minute. Direct steam was also used for the dry-houses and for warming the work rooms. The duty of the engine was to drive a large lot of improved hub, spoke, and felly machinery for making light carriage wheels.

About 12:45 P.M., October 25, the destruction shown in Fig. 4 suddenly took place, caused by the bursting of the shell of right hand or No. 2 boiler. The primary rupture began at the left-hand side, or toward No. 1, on the line A B,

4.

Boiler Explosion at Dayton Wheel Works.

Figs. 5 and 8, just below the overlapping end of the plate at the seam; the secondary rupture, taking the course indicated by the irregular lines in Fig. 5, which extended entirely around the boiler, the force of the expanding water, gushing from this long and suddenly made opening, tore off and flattened out the girdle of plates shown in Fig. 8, and 9,000

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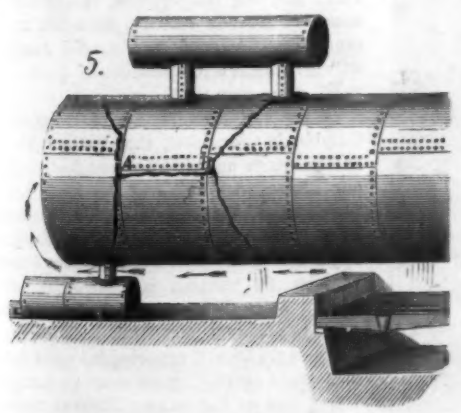


Boiler No. 2, showing initial rupture, A B, and secondary lines of rupture running round the boiler.

pounds of water, more or less, practically exploded simultaneously with its release, giving out as much as 100 heat units per pound of water, each unit capable of raising 772 pounds one foot high. The force, then, including the free steam from both boilers, would probably exceed 500 millions of foot-pounds, which may be considered ample when set free in the fraction of a second to produce the observed effects.

Relating to the cause of the initial rupture a quotation from the Dayton *Journal* is admissible, though it should be taken with caution, as there are several obvious errors in the article. That paper reports the engineer as having said:

"At 12:25 o'clock he had three full gauges of water, and the steam had run down to 75 pounds. In the morning he had carried 90 pounds."

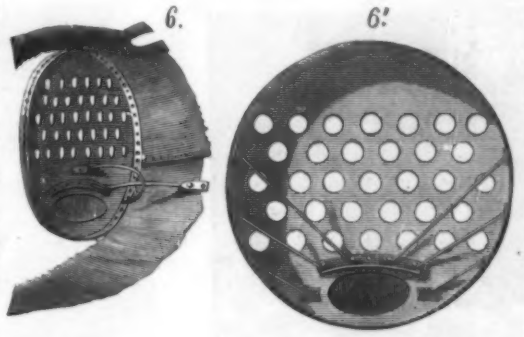
Again, after he had directed Rokel to put fuel in the furnaces so as to keep the fire from dying out, he is reported as having said he "saw that the engine room gauge showed 80 pounds of steam in the engine room, and Rokel cried out to me in the boiler room that the gauge there indicated 75 pounds."

The engineer continues: "The boiler was scaled pretty thick, and I had tried to get as much of it off as I could, but I think the scales had crystallized (the iron?), and thus caused the explosion. This boiler always leaked at this place, and I felt that it was dangerous, so it was repaired last week. It was placed in the house last December, and appeared strong."

The repairs were, calking a longitudinal seam on the other, right-hand, side of the boiler shell, at I, Fig. 8, near the rear head, which had given warnings of its frail condition, while the seam, A B, might not have leaked before rupture took place.

The fact in the case is that the initial defect was a partial fracture just at the edge of the lap, A B, plainly indicated by the different colors on the fractured edge; old black oxide

6. 6'



Rear end of boiler after explosion. Rear end of boiler before explosion.

extending in places nearly half across the fractured edge, indicating brittle, "cold short" iron. And the same is seen at the seam where the marks of the calking tool plainly indicate the location of the leak spoken of by the engineer as having lately been repaired "because he felt that it was dangerous," I, Fig. 8.

The parts of No. 2 boiler are shown on plan, Fig. 1, C being the rear end in the yard of a dwelling 150 feet from the boiler house, shown on a larger scale, Figs. 6 and 6'. D, Fig. 1, is the position of the girdle of plates, enlarged in Fig. 8. E is the point where the front end lay with the dead Rokel, shown enlarged in Fig. 7. F, Fig. 1, shows the position of No. 1, the unbroken boiler, which turned end for end and tore off the corner of the dry-house in the foreground of the plan.

Experts, and especially professional boiler experts, are accustomed to ask steam users to believe that the use of steam can be made safe, and that there is no mystery in boiler explosions; that they are the result of carelessness, ignorance, bad iron, or bad workmanship; but it seems rather discouraging to such as desire to get an idea when they may safely continue to use their boilers, to be put off with such stuff as that contained in the following certificate, which we quote from a local newspaper:

"We, the undersigned, at the request of Messrs. E. H. Brownell & Co., and Messrs. Pinneo & Daniels, have made a thorough examination of their boiler that exploded October 25, 1881, and find the iron in the boiler to be first-class, made by the Licking Rolling Mill Company, and the workmanship good. We are satisfied that Messrs. Pinneo & Daniels took all due pains and spared no expense in having their boiler fitted up in first-class shape, and had provided more than ordinary means for the safety of their boilers, and cannot see that any blame can be attached to Messrs. Brownell & Co. as makers, or Messrs. Pinneo & Daniels. We find that Mr. Peter Aplin bears the name of a careful and experienced engineer, and one of the best in the city. By testing one of the steam gauges, we find it worked correctly. We find no indications of low water. We find it impossible to determine the cause of the explosion.

AID COLLINS,
Of the Hartford Steam Boiler Inspection and Insurance Company.
JOHN L. PFAU,
Of the Swift Iron and Steel Works.
J. H. VAILE,
Of Smith, Vaile & Co.
SIMON SPARKS, M. M.,
With Woodsum Machine Company."

The owners of these new and apparently well made and thoroughly equipped boilers ought not to be told that it is impossible to determine the cause for the explosion. They, in common with most thinking men, no doubt believe that there was a sufficient cause, which somebody ought to be able to explain.

Although a greater pressure than 80 or 90 pounds is not needed to account for this destruction, yet it is not improbable that the pressure, even with two steam gauges themselves in order, and two safety valves of ample size, might have been much above the indications reported. The gauge pipe common to both gauges being accidentally obstructed is all that we require, together with the faulty safety valves, which are illustrated on an enlarged scale in Fig. 9, to fatally

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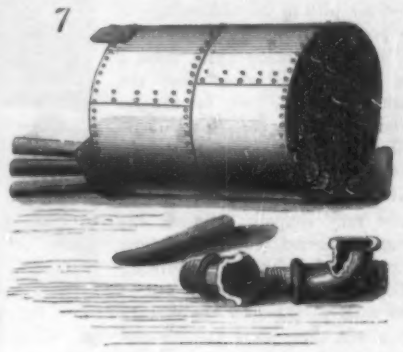


Front end of boiler after explosion.

mislead an observer as to the pressure actually endured by the boilers, both of which were in use at the time of the accident. With perfect safety valves, the boilers being sound and good, the hardest firing would not have dangerously increased the pressure, even though the temporary fireman was densely ignorant of the duties of a boiler attendant.

Referring to the cut (Fig. 9) it will be seen that the safety valves were broad disks with three short guide rings and a broad seat. The short blunt stem or teat on which the lever rests is seen to be very close to the lever pivot, barely two inches. These teats were not turned, and might or might not be in the axis of the valve. If the point upon which the lever rests is not central, then a uniform pressure upon the disk below would raise only the side having the larger radius, and "jam" the rings fast in the seat or guide ring. Once in that plight the current of steam toward the crescent-shaped opening would impinge on the rings and tend to increase the difficulty without materially relieving the boilers of pressure. One of these valves bore marks of having been jammed in this way so as to bruise the guide rings.

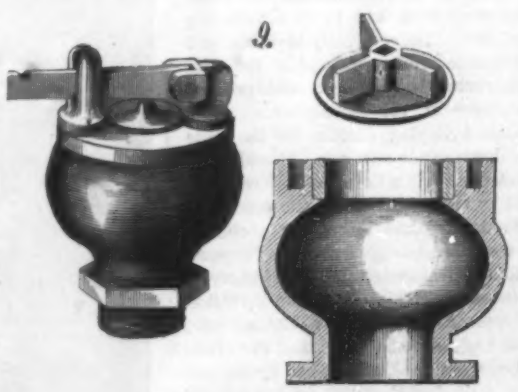
The SCIENTIFIC AMERICAN has made a careful examination of the exploded boiler of Messrs. Pinneo & Daniels, and

8

Girdle of plates torn from No. 2 boiler. A B, line of initial rupture. 1, locality of leak mentioned by the engineer.

finds that the explosion was due to the bad quality of the iron at the line A B; that the plate at this point was brittle; that this brittle iron was subjected to slight hinge-bending motions, caused by variations of pressure on the flattened portion of the boiler at the broad seam; that these motions tended to crack the poor iron; that the plate at the line A B showed the existence of a crack of older date than the explosion; that the steam pressure indicated by the engine

9.



Details of Safety Valve.

room gauge was sufficient to cause the explosion, in view of the cracked and impoverished nature of the iron.

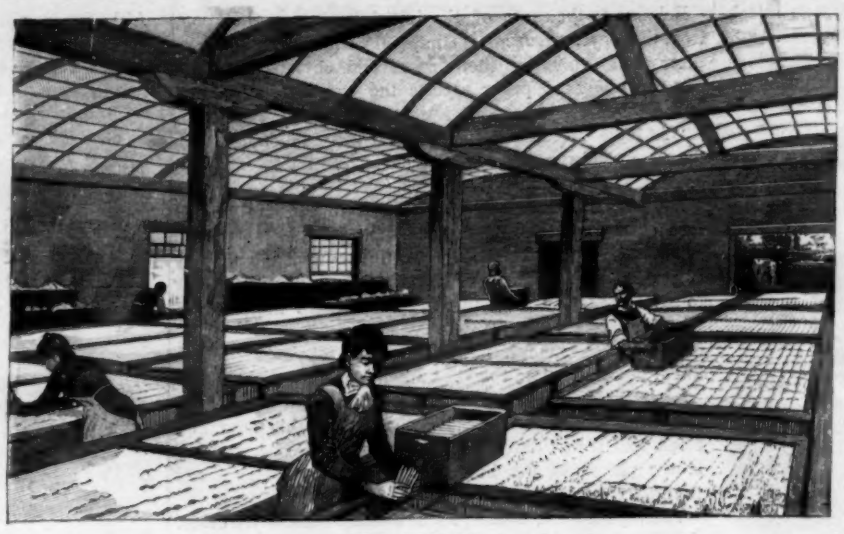
Speed of the Servia.

The new Cunard steamer Servia was tested for speed November 19. The vessel was repeatedly run at the measured mile, and ultimately taken out into the channel and run back between the Cumbrae and Clock lighthouses, a distance of 15¾ statute miles, the result of the day being that she attained the remarkable speed of 20¼ statute miles per hour, having on board 2,500 tons of dead weight.

THE MANUFACTURE OF CANDLES.

[*Continued from first page.*]

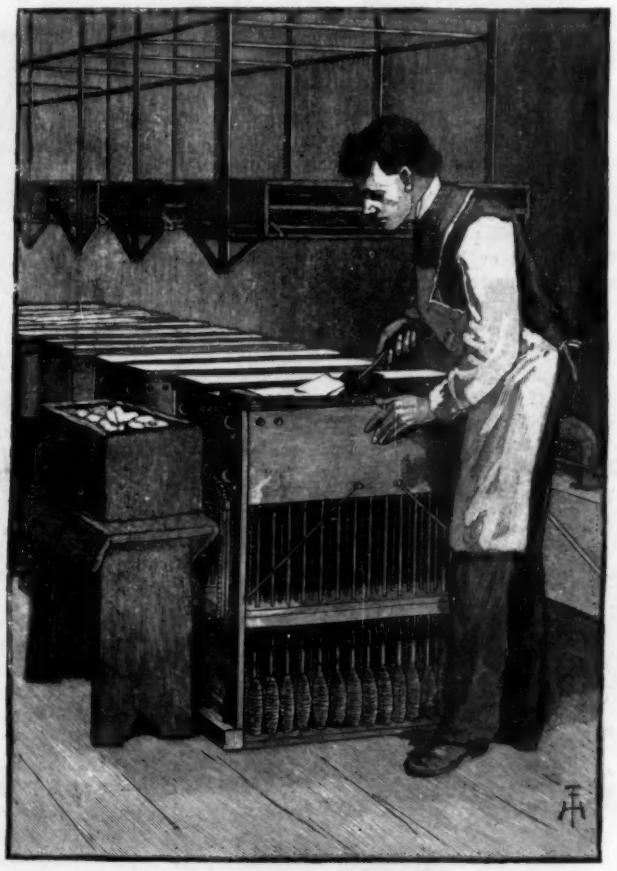
nineteenth century were not many. First the pine knot, then the oil nuts on a skewer—which is now the means of illuminating used by the Otaheitans and Society Islanders, who are not far behind the rural housewife of not long ago, who gathered rushes, peeled them on one side, and soaked the pith in the skimmings of the bacon pot, or our mothers, who hung a row of wicks of cotton yarn upon a stick, and dipped the wicks into the melted tallow prepared only by the removal of the membranes, etc., in the shape of cracklings. The operation had to be repeated several times, until sufficient tallow had hardened around the wick to make a not very shapely cylinder, the sticks being supported, while the tallow cooled, by parallel bean poles or quilting frames. Dipping day then was not looked forward to with pleasure by the cleanly housewife; it was dirty work at best—the kitchen floor was bound to suffer unless the weather permitted the dipping to be done in the yard or under the cover of the woodshed. Cool days in the spring or fall were chosen, so that the tallow might harden quickly and evenly, and if the attic supply gave out in the midst of warm weather, the grocery had to be patronized for the crude mould candles just coming into use. In those days the construction of kettles specially adapted to melting the tallow and keeping it at an even temperature, and a contrivance for expediting the dipping by putting the rods with the rows of looped wicks upon a revolving rack, marked substantially all the advance of the tallow chandler's art. Aided by all these appliances, a workman could dip probably three or four thousand candles in a long day, and congratulate himself on his luck and his skill, but in the warm weather he had to do the dipping in the cool of the very early morning, and doubtless he often wondered if the time would come when his work could proceed in defiance of the thermometer. This method of dipping candles for the trade came down to our own day. Moulds were invented in Paris in the eighteenth century, but it was not until the whole process of candle-making had undergone a change that they came into general use and stopped the domestic manufacture. The history of tallow-candle making up to the invention of the modern method is a curious one, because of the long time that the crude methods obtained, and it has its complement in the fact that wax candles are still made by kneading the softened wax to the wick with the fingers; the candle is then given a symmetrical shape by rolling it between marble or wooden slabs. Moulds cannot be used here, because of the great shrinkage which melted wax undergoes while cooling. Doubtless the wax candles were made in this way which King Alfred caused to be marked into divisions and shut up in this horn lantern, that by their graduated burning he might apportion his hours to study and devotion and sleep. "Asser's Annals" preserve the great king's directions: "He commanded his chaplain to supply wax in sufficient quantities, and he caused it to be weighed in such a manner that when there was so much of it as would equal the weight of seventy-two pence, he caused the chaplain to make six candles thereof, each of equal length, so that each candle might have twelve divisions marked across it." Each of these divisions burned one-third of an hour, so that the six candles lasted one day.



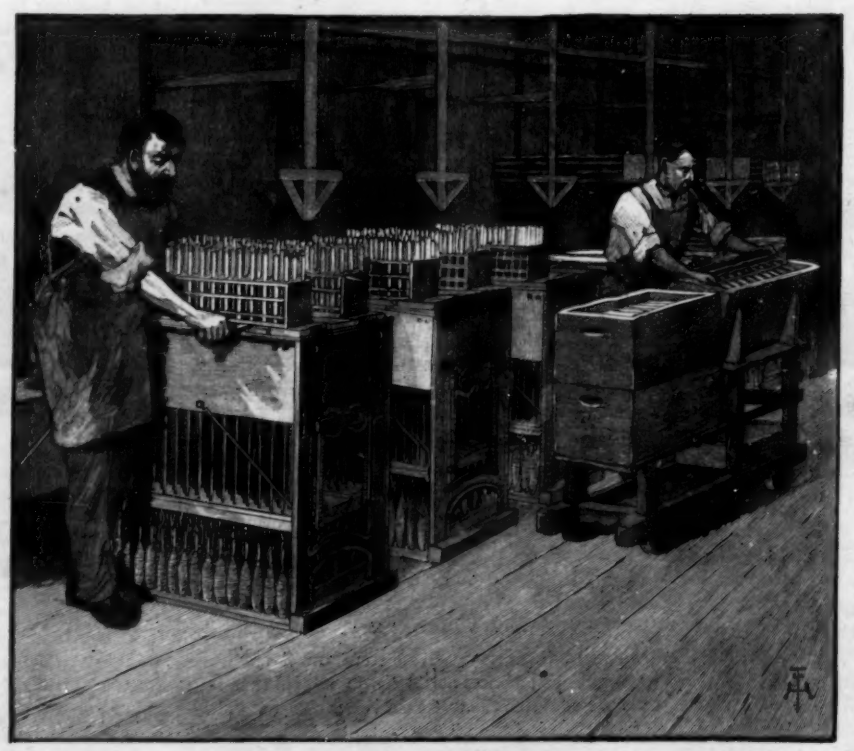
THE BLEACH.

TEMPERING.

The discovery of gas lighting and improvements in lamps have done much to curtail the manufacture of candles, but it is yet a vast industry. An estimate of the consumption in the United States places it at twenty-two millions pounds annually. Candles are still the staple illuminating medium for the poor of large cities, and for all classes in small towns and villages where there are either insufficient or no gas works. Country hotels and taverns are large consumers, and the preference of many people for candles over lamps, as portable lights, keeps up a constant demand in all sections. Candles likewise are the true aristocrats among illuminators, and the renaissance in art taste which holds no illuminating medium to be quite so beautiful and effective as the candle for dinner tables and party and ball rooms, calls for an extensive manufacture of fine grades. Now, it is not the beauty of the polished brass or silver candelabrum alone which makes appeal to the æsthetic judgment, for, except the yet imperfect electric light, no illuminator can give so pure and white a light as a perfect candle. The finest fruit of science applied to the once homely industry is the stearic acid mould candle of to-day, which is not only quite as handsome in appearance as the wax candle, but burns with equal brilliancy and purity, and has to a great extent usurped the place of the more costly light. The mines of the far West share with the boudoirs and *salons* and dining rooms of the East in the consumption of the best of these candles. A very large proportion of the finest grades goes to Nevada, Colorado, and the other mining



SCRAPING OFF SURPLUS.

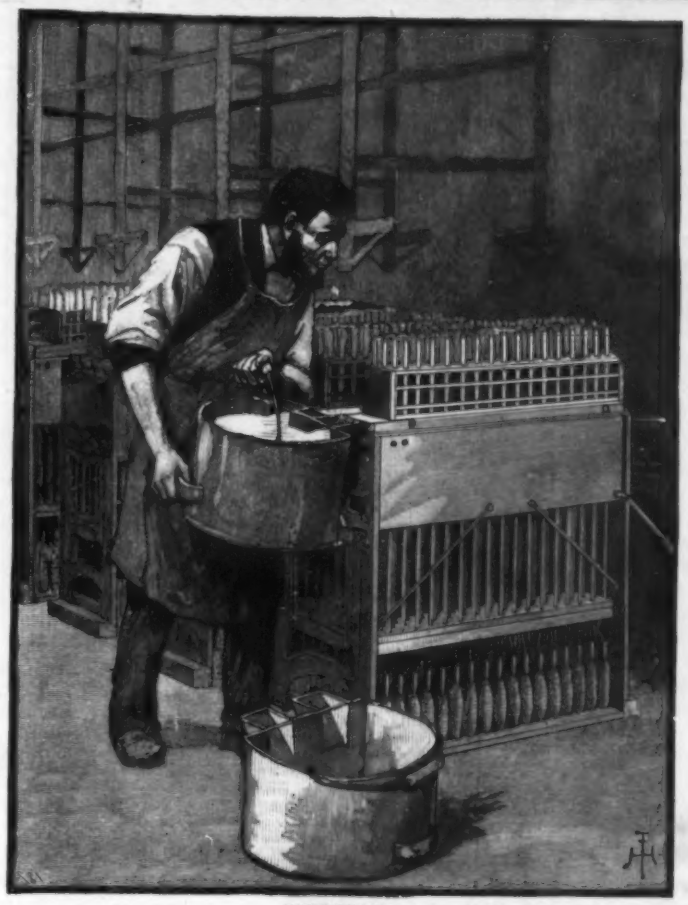


CUTTING AND CARRYING OFF.

States and Territories of the Pacific slope, the high temperature of the mines demanding a very hard and pure candle. The old candle would be entirely useless here, for tallow melts at from 90° to 104° Fah., and the temperature of the deep mines of Nevada often reaches 120° and even 130°. A good stearic acid candle will withstand a temperature of from 15° to 10° more than this.

To the vast manufactory of Procter & Gamble, in Cincinnati, the most complete and extensive on this continent, we go for our illustrations and our description of their process, for there the most recent and most perfect of scientific and mechanical appliances are kept at work, and the latest of scientific research is constantly utilized. More than *one hundred thousand* candles are sent out from this factory every day, which, if moulded into one candle, would make it *eleven miles* in length. Every step of the process through which they pass, from the time the fats are deposited into the emptying room until the pretty cylinders, snugly packed in boxes, are sent to all parts of the world, is full either of interest to the student or entertainment to the simply curious. For the edification of the seeker after knowledge as well as those whose curiosity interests them in wishing to know "how to make candles," we will give both the scientific and the mechanical means of candle-making.

The stearic acid candle, which is now the principal candle of trade, represents the high-water mark of the progress in candle-making which began fifty years ago. Unlike its primitive predecessor, the tallow dip, it is a product of scientific study, and one of the many triumphs of philosophic chemistry. The movement which effected a complete revolution in the industry, and ran a rapid growth after once it was started, was an outcome of the discoveries of M. E. Chevreul, the French chemist, published to the world in 1823, in his book, "Recherches sur les Corps Gras, d'origine animale." In it lies the foundation of all our present knowledge of the chemistry of fatty oils, and this knowledge is the starting point of modern candle-making. Chevreul established the scientific fact that, as a rule, all fatty oils, both liquid and solid, are neutral compounds of glycerine and the so-called fatty acids. In tallow and other candle fats, these acids are stearic and oleic. A third acid, called margaric, also enters in small proportions, but it occupies very little attention. Stearic acid is a crystalline substance, unctuous to the touch, but not greasy. It melts at a temperature a little short of 150°, and when burned through a wick gives out a white and clean light. Oleic acid is liquid at common temperatures, and was the cause of the melting of the old tallow candles at a temperature 50° lower than is withstood by pure stearic acid. The glycerine base caused them to burn yellow, and to smoke with an offensive odor. The discovery of the chemical properties of these constituent elements of candle fat led with a single step to the fundamental idea of the improvement in candle-making: the oleic acid and glycerine are deleterious to the candle, and must be removed; and all the steps since taken—and they followed hard on the heels of the first—have looked to the doing of this in the most expeditious and cheap manner, and the perfection of the moulding machinery. Naturally the first processes were chemical, but they put a great obstacle of costliness in the way of the manufacture which almost proved fatal. The early industry, after surmounting this difficulty by combining mechanical means with chemical in separating and purifying the fats, again came near suffering shipwreck from another cause. It was found by the French chandlers, to whom belongs much credit for developing as well as originating the modern method, that the stearic acid on cooling in the mould crystallized, and the candles became unsightly, brittle, and uneven of combustion. The remedy appeared to lie in breaking the grain of the acid, and this was done by the introduction of a powder. Unfortunately, white arsenic was the powder chosen, and the result was so noticeably injurious to health that Chevreul's discoveries were brought into disrepute, and the early art of stearic acid candle-making was almost annihilated. Better study found a simple and harmless remedy to lie in lowering the temperature of the acid before pouring it into the mould, and in heating the mould to receive it. Improvements were also successively made in the methods of preparing the fat, and when, finally, American ingenuity was brought to bear upon the mechanical side of the problem, a machine was developed out of Sieur de Brez's last-century mould that has marvelously simplified and cheapened the manufacture of candles. The purification of the fat had done much to improve the combustion, and the smoke had been abolished; the flame, too, had become much brighter and clearer, and the snuffing of the wick had become less necessary, for, the combustion being more perfect, the wick, whose only duty is to conduct the oil to the flame, was more nearly consumed. A little attention to the making of wicks soon banished the snuffers and the snuff tray to the curiosity shops of the antiquaries.



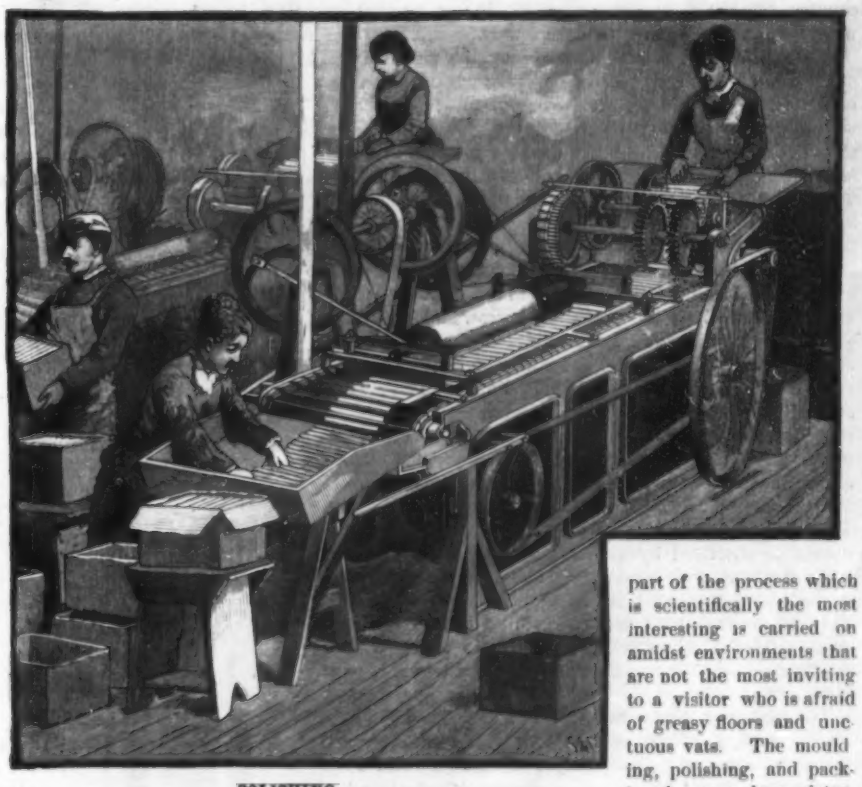
MOULDING.

The old-fashioned wicks were simply twisted. Cambaceres conceived the plan of plaiting them, with one strand drawn tighter than the others. In the candle the wick is kept straight by the hardened fat, but, when released by the flame, the tightened strand draws the end of the wick over to one side, so that it is brought in contact with the outer envelope of the flame, where the combustion is most perfect because of the liberal supply of oxygen received from the air, and thus the wick is continuously consumed. The process is helped by steeping the wick in boracic acid, in order that a glassy bead may be formed at the end of the wick, and drop off by its own weight. This plan was suggested by De Milly in 1830.

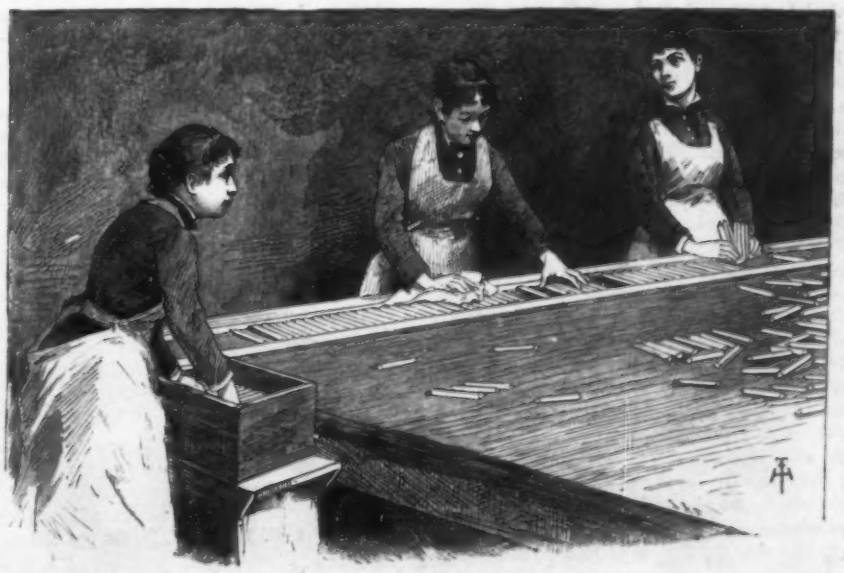
Fortunately, a promenade through the factory in fancy is attended with consequences much less disagreeable than the actual walk, for all that part of the process which is scientifically the most interesting is carried on amidst environments that are not the most inviting to a visitor who is afraid of greasy floors and unctuous vats. The moulding, polishing, and packing, however, have picturesque phases which appeal to even a dainty æsthetical sense. Three processes are necessary in the preparation of the fat for the mould. The glycerine must be removed, the acids must be freed from the new base combined in getting rid of the old, and the solid acids must be separated from the liquid. In the first process the principle followed is the law in chemistry, according to which a strong base under favorable conditions will separate a weaker one from its acids by combining with the acids and taking the place of the weaker base. The fat is thereby saponified, a soap being formed, which is next decomposed, the fatty acids liberated and then separated. In this last process begins the employment of mechanical instead of chemical means, for, though repeated dilutions would effect a more perfect separation of the acids, the plan pursued is quicker, cheaper, and sufficiently effective for the purpose desired.

The saponification of the fat is accomplished in an apparatus called, in chandler's parlance, the "digester." It consists of a copper cylinder inclosed within an iron one, and a pump arranged to force the contents of the inner cylinder from the bottom to the top. Into this the fat, which

RAISING THE CANDLES

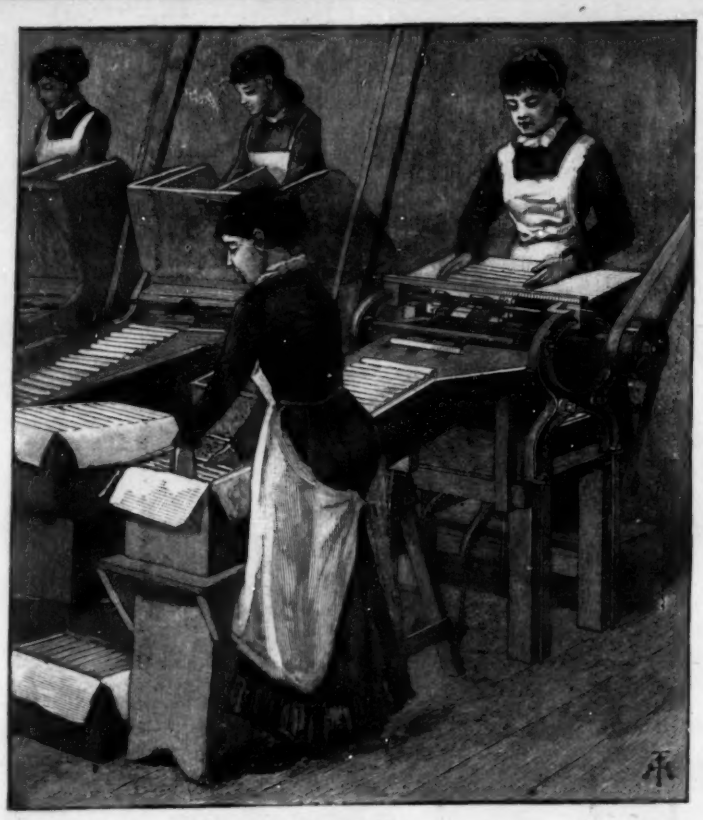


POLISHING.



HAND POLISHING.

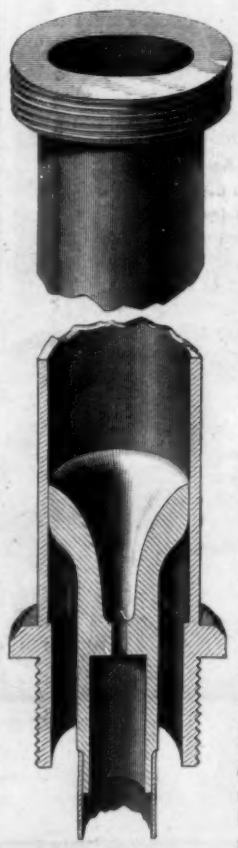
has been melted out of the barrels by steam, is run and is mixed with lime and water. The mixture is kept at a heat of 600° Fah. by steam which is let into the outer cylinder at a pressure of two hundred and fifty pounds to the square inch. The water, being the heavier, sinks to the bottom of the copper cylinder, whence it is pumped and thrown on a perforated plate above the fat, that it may fall through it in many little streams. This agitation is kept up for eight or nine hours, after which it is found that the lime has united with the fat acids and formed a soap, while the water has consorted with the dissociated glycerine. The contents of the cylinder, after being permitted to remain at rest for a time, separate into two strata, the lime soap on top, the crude glycerine and water below. These are blown off to separate vats by the power of steam. It is from the candle factories that the enormous supply of glycerine comes, which is now a very important article of trade. A few years ago it was wasted; now it is sent to the manufacturing chemist, who purifies it by distillation and filtration through bone charcoal, and puts it upon the market. It is put to a great variety of uses, many of which depend upon its peculiar properties of non-volatility and absorption of atmospheric moisture. Harness makers and leather workers use it in making leather pliable; it is put into gas meters because it does not freeze except at a very low temperature; modelers keep their clay studies moist with it; tobacconists sweeten chewing tobacco with it, and ladies apply it to their hands and faces to soften the skin. Much of it goes into the manufacture of the terrible explosive nitro-glycerine, which is made by treating it with a mixture of sulphuric and nitric acid, or concentrated nitric acid. Not less than three million two hundred thousand pounds of glycerine are produced by the candle factories and utilized every year in this country, and yet so late as the year 1854 it was counted as worthless, and was run off into the sewers.



STAMPING.

When the French chandlers first began the manufacture of the new-process candles, and for a long while after, they permitted the lime soap to become hard, and then ground it up in order to dissociate the lime from the fat acids. Now this is done without delay, the liquid soap being run into lead-lined vats with a proportion of sulphuric acid added. The chemical principle involved is the same as in the more laborious process of saponification; the glycerine base has been supplanted by the lime base, and this must now be got rid of. The sulphuric acid takes hold of the lime, forming sulphate of lime, and the acids float off free. In these vats, between which the paths are narrow and the walks greasy, the liquid settles in three strata—the first, the fat acids, now free of their base, but still mingled; the second, an acid water; the third, sulphate of lime, a waste. They are easily drawn off without mixing, and the fat acids, by washing in boiling water, are cleaned of all traces of the sulphuric acid, and we are now done with the chemical processes, and our product is a fat which contains the solid and the liquid acids. If cooled rapidly or kept agitated while cooling, the acids become so intermingled that they cannot be separated by mechanical means, which at this stage of manufacture must replace the chemical, on the score of cheapness. If the fat is cooled very slowly, however, it has been found that the solid acids will crystallize, while the liquid acid, the oleic which it is desired to banish, will lie snugly ensconced between the crystals, to be afterward forced out by heavy pressure.

The cooling of the fat is a slow process. It is run into shallow pans, lined with enamel to prevent the acids from eating the metal, and permitted to remain in a warm room two or three days. These pans are arranged in sections, like alcoves in a library, one row of pans underneath the other, and each extending a slight distance alternately to front or rear beyond the one above it. The hot fat is conducted over the top of the alcove in a wooden chute, and the filling of all the pans down to the floor is accomplished by taking a plug from the chute immediately over the top pan. When this is full it overflows at the front end by means of the slight depression made at that end, and the overflow is caught by the pan below, and so on down to the bottom. When the fat is become hard it is a cake of a brown, greasy mass, not unlike unrefined maple sugar. The discoloration comes from the oleic acid, which permeates the whole cake and can be forced from between the crystals of the hard acids by pressure with the thumb. The cakes are wrapped in heavy woolen cloths, piled into hydraulic presses between iron plates, and the pressure applied. A dark oil gushes from the woolen, pours over the edges of the plates, and is caught up beneath the press to be used in soap-making. The cakes have now been squeezed down to less than two-thirds of their original thickness, and the mass presents a yellowish-white appearance. By breaking it, its crystalline texture can still be seen despite the fact that the shape of the crystals has been ruined by the pressure it has undergone. They are still somewhat greasy to the touch, for in this first pressure only fifty per cent of the oleic acid has been removed. They now succeed to a second pressure, this time in a horizontal press, and between hollow iron plates that are kept hot by steam. Still wrapped in the woolen cloths, they are suspended between the plates in bags of horsehair cloth, and a very heavy pressure is applied from the end. When the cakes issue from this process they are as white almost as snow, very hard and dry, and when broken into small particles have a flaky appearance. The mass is now almost pure stearic acid, and is ready to be moulded into star or adamantine candles. Without an exception, this single hot pressing is deemed by other manufacturers to be sufficient for their higher grades of candles, such as are used for mining, dining room, or library, but Messrs. Procter & Gamble have learned that by again breaking up the cakes, melting, panning, and pressing in the hot press, a much better candle is produced, better because there is no smoke, the light is whiter, and consequently much stronger, and the candles last longer. These are strong points, especially where the candles are to be used for mining or in a close room, or where a pure, soft, white light is desirable, such as at a dinner party or reception.



A MOULD.

These are the scientific phases through which the stearic acid candle goes; what follows it is simply the fruit of the inventive faculty of our day. The visitor emerges from dark basement rooms, where he has been moving between tubs and under pipes and chutes all dripping with liquid grease, into a room on the ground floor. Here there is light in plenty, and opening off one side is a vista of a room vast in extent, with a glass roof like a hothouse, with long rows of tables separated by narrow paths, on which, bolt upright, stand thousands of shapely candles undergoing a brief bleaching process by sunlight. One end of the first room is filled with vats in which the prepared candle fat is melted, purified, sometimes colored, and brought to the temperature requisite for moulding. Utility is here, of course, the guiding consideration, but the group of big and little tubs, with the men moving among them, is not without its picturesque element. Upon the edges, and hanging from the spouts at which the moulder fills his double-lipped can, the candle fat has hardened in fantastic shapes, with surfaces of ivory-like smoothness and sheen. The floor of the room is covered with moulds. In these moulds there is little remaining of the group of tin tubes through which the domestic candle maker, who had got beyond dips a few years ago, laboriously drew her wicks, to fasten them below with a knot, and above by looping them over little sticks. The tubes are now fixed in a frame having troughs along the top, into which they all open. They end below with the shoulder of the candle, and the moulds for the tips are the upper ends of piston rods, which, by a rack and pinion, are forced upward through the tubes to expel the candles, and which, when at rest, fall snugly into the shoulders. These rods are hollow, and the wicks pass continuously through them from bobbins placed in the floor of the frame. Care is exercised to have the fat at a temperature just above the melting point, to heat the mould to receive it, and immediately to cool it rapidly by forcing around the tubes a blast of cold air, so that the fat shall not crystallize as it did in the panning. When the candles are hard, the surplus fat in the troughs is removed, and a few turns of a handle forces them upward out of the moulds and into a rack placed on top of the machine to receive them. The lower board of the receiving rack is slightly shifted, so that the edges of the openings through which the candles pass catch the shoulders of the candles, and prevent them from dropping back into the moulds with the piston rods. These rods in expelling the candles draw up with them wicks for the next pouring, and in falling back into position pull the wicks taut and into place through the middle of the tubes. The candles in the rack are left until the next mouldful is cold; then the wicks are cut by passing a knife between the mould frame and the rack, and they are emptied into boxes, which are mounted on trucks, and pushed from mould to mould. Bleaching, polishing, stamping, and packing are all that remain to be done. The first process takes place in the adjoining room already mentioned; a few hours of sunlight bleaches the yellowish tinge out of the fat. Common grades are then rubbed with cloths and packed; better grades are polished by a machine, into one end of which they are fed by one woman, while another packs them into boxes from the other. The process is very simple: a grooved cylinder receives the candles from the feeder, and after carrying them past a revolving saw, which cuts off the butts evenly, deposits them upon a bed plate between the rods of an endless frame with linked sides, kept in motion by cog wheels. Over this bed plate they roll under a revolving buffer, which gives them a vigorous brushing from end to end, and gives them the beautiful porcelain finish as they pass toward the end where they roll off into the packer's box. All grades are stamped with the name of the maker, and in some instances the trade name of the candle, "Composite," etc. This stamp is melted into them by a branding iron as they pass through a small machine, which, like the polisher, is fed by a grooved cylinder.

MISCELLANEOUS INVENTIONS.

Mr. John B. Casley, of Coolville, Ohio, has patented an improvement in metal roofing. This invention relates to that class of metal roofs in which the ends of the sheets are bent upward to form flanges which are held on the roof by anchors. The invention consists in the combination, with flanged roofing plates, of an anchor provided with one or more prongs at the upper end and with an enlargement or bead at the inner end. This anchor is passed into a slit or cut in the edge of the roofing strips or boards, the enlarged part or bead resting against the inner surface thereof, whereas the prongs project above the flanges of the metal sheets, and are then bent down over these flanges. The flanges may be bent one over the other, or the joint may be covered by a cap. By this invention the plates are held firmly by the anchors, and can be attached to the building very rapidly and conveniently. The plates can be attached to the sides of a house in the same manner.

A very efficient carpet stretcher has been patented by Mr. David G. Rulon, of Monmouth, Ill. In this device a clutch bar, which lies flat upon the carpet, and has inclined steel points that catch into the latter, is connected by cords or chains with a rear bar, which is provided with steel points that pass through the carpet and into the floor. The clutch bar is moved forward to stretch the carpet by a lever having a steel point that sticks into the floor, said lever passing through a loop in a draw cord, that rests by its loop in any one of a series of hooks on the lever, while the ends of the cord are connected with the clutch bar by draw rods, which keep

said bar from turning. After the carpet has been fully stretched, the clutch bar is carried over and behind the rear bar, out of the way, to provide for tacking the carpet down near the wall.

An improved spring lock earring has been patented by Mr. Fred R. Bassett, of Paw Paw, Mich. The invention consists in hinging the hook to the pendant, and providing a spring for holding the hook open or closed, the hook being formed with square faces at the pivot for the impingement of one end of the spring upon either one of said faces, accordingly as the hook is thrown open or closed. This improvement not only gives greater convenience in attaching, fastening, and removing the ring from the ear, but less gold wire is required for the hook, no eye is needed for fastening the end of the hook, and the hook is not liable to be broken, as it does not have to be bent every time the ring is inserted and removed from the ear, as is the case with the ordinary style of hooks.

An improved sofa bed, which is free from complicated devices to adapt it for use as a sofa or a bed, and which may be so adapted without unduly stretching or crowding its upholstering, has been patented by Mr. Herman A. W. Maercklein, of Hartford, Conn. In this improvement the hinged back and main frame of the sofa have combined with them hinged plates, which, when raised or closed, hold the back in a vertical position, and, when lowered, permit the back to occupy a horizontal one. The stationary sofa arms and the lowering back have also combined with them bolsters hinged to said arms at their rear ends and avoiding the appearance of a hinge joint at the sofa front. Furthermore, the back and seat are connected by hinges having pin joints on a line with the tops of the springs in the seat, whereby all undue crowding and stretching of the springs are avoided.

Mr. King G. Streeter, of Littleton, N. H., has patented a very neat and durable glove fastening. In this device a tubular shank, having an eye on its outer end, is secured to the glove on one side of the wrist opening. Through this eye is loosely fitted a wire bent in reverse directions at its opposite ends, which latter have knobs that prevent the wire from dropping out of the eye. In using the fastener, one end of the wire is passed through the button hole in the glove wrist, and said rod or wire then used as a lever to draw the parts of the glove wrist together. The other end of the rod is next passed through the button hole, and the rod afterwards adjusted to bring its central portion within the eye. The button hole is fitted with an oblong eyelet to prevent the glove wrist from being worn or torn around the button hole.

A simple and inexpensive fastening for hats and bonnets, which may be secured in position without the use of needle and thread, has been patented by Mrs. Josephine A. McK. Bouvier, of Denver, Col. The invention consists in a button having a portion of its back cut away to form an opening, and the remaining portion of said back provided with a keyhole slot, which communicates with said opening, and is adapted to receive a knotted cord. This cord, which may be elastic, being thus secured at its one end, without sewing to the button, may be attached at its other end to the hat by a clasp, and said button, when securing the hat to the head, be passed through a looped cord secured to the other side of the hat by clasp or otherwise.

An improved ore concentrator, which is designed to be connected with crushing rolls or other crushing machines, or to receive the ore directly from them, has been patented by Mr. William Thurmond, of Rosita, Col. In this concentrator a V-shaped box set slightly inclining from a horizontal position, and formed with an enlarged cylindrical chamber at its narrowest end, is connected at said end with an exhaust fan and provided at its opposite end with a current regulating slide. Within the V-shaped chamber of the box is a rocking or vibrating frame, having screens of various degrees of fineness for separating the different grades of crushed ore, while the dust and lighter particles are drawn out by the fan. Chutes in the bottom of the box conduct the graded ore to suitable receptacles, and a separate chute carries off the gangue. Ore concentrators thus constructed are said to perform their work perfectly.

An improved tire-tightener, which operates by expanding the felly of a wheel to completely fill the tire and thus firmly unites the felly and the tire, has been patented by Mr. Benjamin F. Carlon, of Red Oak, Iowa. The device consists of two arms having jaws and binding screws at their outer ends to receive and hold the felly, which arms are pivoted to a forked swivel head loosely mounted in the top of a capstan head on a screw which fits into a threaded aperture of a pedestal or base that rests against the hub of the wheel between the spokes. By turning in a given direction the capstan head of the screw the felly will be expanded as required, and washers can be passed into the joint to fill up the space between the ends of the fellies. This useful contrivance may also be used as a jack to lift wagons and other loads.

An improvement in photographic apparatus, which possesses both novelty and merit, has been patented by Mr. David H. Houston, of Cambria, Wis. The object of this invention is to facilitate taking a number of photographic views successfully and in a short time. The invention consists in a camera with a receptacle or box at its inner end containing a roll of sensitized paper or other suitable tissue, and an empty reel, upon which the sensitized band is wound as rapidly as it has been acted upon by the light, thus obtaining a number of views successively upon the same band, which is afterward divided as required. Said band is arranged to pass from the supply roll to the take-up reel, over rollers at a suitable distance apart and through slots in front of the box. On the shaft of one of these rollers is a pointer for indicating the amount of tissue drawn to form one negative, and a perforator on said roller for indicating the dividing points in the band for a series of negatives. The end pieces of the front end frame of the bellows of the camera also is arranged to swing on the sliding side pieces of the bellows box.

Correspondence.

Curious Freak of a Dog.

To the Editor of the Scientific American:

Being a constant and close reader of your valuable paper, and having gleaned many curious and instructive facts of natural history from its pages, it has occurred to me that the following freak of a dog which we own would not be uninteresting to some of your readers.

"Simmons" (that is the dog's name) is very remarkable for her sagacity, and often excites remark by the "reasonableness" of her actions. She is a constant companion of the boys, and seems to consider herself one of them. She has been a mother three times; the third time some ten days or so ago. At her two former *accouchements* she did herself credit by the respectable size of the family she brought to light; but this last time she gave birth to but one pup. Two or three days before the birth of this pup there was a litter of kittens born on the place. Simmons, disgusted at the smallness of her family, and evidently thinking that the cat had more than her share, captured one of the kittens in the absence of the old cat, and carried it in her mouth to where she kept her pup, and deposited it in her basket. In a short time she was suckling both the pup and kitten, who were hard at work side by side. The next day the kitten was taken away in the absence of Simmons, but on her return she hunted up her adopted child and brought it back to her basket, where it has remained until now. Simmons has now been nursing the kitten for more than a week, the kitten seeming to be perfectly satisfied with her foster-mother.

This may not be an isolated case of the kind, yet it is nevertheless remarkable.

H. U. ONDERDONK, M.D.

College of St. James, Washington Co., Md, Nov., 1881.

Rain of Spider Webs.

To the Editor of the Scientific American:

I notice in the SCIENTIFIC AMERICAN of November 26, 1881, an article headed a "Rain of Spider Webs." This rain occurred in Wisconsin in the latter part of October. It might be interesting to refer to another locality and another date, where and when a similar shower was seen. In this place (Bloomington, Indiana), on October 9, about two o'clock, my attention was called to the number of spider lines streaming from a telegraph wire running from the house at a height of about eighteen feet from the ground. At this time I did not notice any in the air, but going along the road I observed some webs on the fences, but not in great numbers. Returning to the house a little before five o'clock, we found the telegraph wire almost fringed with them; every two or three inches, as far as we could see, there were streamers of cobwebs of from four or five inches in length to about fifteen feet, all directed nearly horizontally toward the south. We now saw in the air many lines detached, drifting southward in constantly varying curves. These lines were plainly visible at a distance of over two hundred yards, glancing in sunlight reflected from or inflected by them. We observed, also, several tufts or "parachutes" floating with the spider lines.

I find recorded in my notebook another instance of the same kind. It occurred September 20, 1874. Noticed the appearance about five o'clock. The air at this time was filled with dust, the season being very dry. The long waving lines of light, whose general direction was nearly vertical, were seen drifting from north to south nearly parallel to the ground. They could be seen at the same distance as those already described. We watched them till sunset; for a few minutes but few could be seen, then the number would increase, but upon the whole there seemed to be no diminution as long as the sun shone upon them. The tufts of *gathered cobwebs* were more numerous than in the shower of October 9.

T. A. WYLIE.

Bloomington, Ind., Nov. 22, 1881.

Cast Iron Flat Heads for Boilers.

To the Editor of the Scientific American:

As the question of the safety of cast iron "flat" boiler heads for cylindrical boilers appears again to have come to the surface, I give you below what has been the practice in past years by builders of high standing in proportioning such heads, and which have been used without accident.

The proportions of one builder are as follows: For boiler 24 inches diameter, heads 1⅛ inches thick; for boiler 28 inches diameter, heads 1⅛ inches thick; for boiler 30 inches diameter, heads 1¼ inches thick; for boiler 36 inches diameter, heads 2⅛ inches thick; and of another extensive builder: For boiler 30 inches diameter, heads 1⅛ inches thick; for boiler 36 inches diameter, heads 1⅜ inches thick; for boiler 42 inches diameter, heads 2 inches thick.

I have also examined the heads of old boilers which had been in use for years carrying 80 lb. steam, heads 36 inches diameter and 1⅜ inches thick; and of others in use for years carrying 110 lb. steam, heads 36 inches diameter and 1⅝ inches thick.

OBSERVER.

[The above data is furnished to us by an experienced steam engineer, and is brought out, we presume, by the recent publication, in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 308, of Mr. W. Barnet Le Van's letter relative to the Gaffney boiler explosion, Philadelphia. In that letter Mr. Le Van states, among other things, that no competent engineer would approve of flat cast iron heads, especially 36 inches diameter and 2 inches thick. We think that Mr. Le Van is greatly mistaken. If the information we have received is correct a very large proportion of all the ordinary cylinder boilers now running have flat heads, have been run for many years in safety, and were originally, and are still, approved by competent engineers.—EDS.]

An American Triumph in Electric Lighting.

To the Editor of the Scientific American:

SIR: I have been somewhat surprised to find that no mention was made, except in the foreign papers, of an extraordinary test of electric lights made during the Electric Exhibition at Paris. It was a test made for the *Credit Lyonnais*, the great French financial institution, who were negotiating for the Brush patents for France, and consisted in running two 40-light machines in series burning 38 lights each, 76 lights in all, on a twenty mile circuit, 16 hours a day for 30 days. The lights, during the whole period, burned with great steadiness, and the test was so satisfactory that, at its conclusion, the patents for France were purchased for between $400,000 and $500,000. This is the largest sum that has been paid, I understand, for any electric light patents of any American inventor. The French company, I was told in Paris, had already begun an immense manufactory for the manufacture of apparatus.

C. C. RUTHRAUFF.

Cleveland, Ohio, Nov. 25, 1881.

Fall of a Meteorite in England.

BY PROF. A. S. HERSCHEL, M.A., F.R.A.S.

A stonefall took place at 3:35 P.M., on March 14, 1881, a mile and three-quarters from Middlesborough, in Yorkshire, along the branch line of the Northeastern Railway from Middlesborough to Guisborough, at a place known as Pennyman's Siding, on the railway. The fall was accompanied by the usual thunder-like report, not heard at the place where the meteorite struck the earth, but as far off as Northallerton and Welbury, in Yorkshire.

Some workmen's attention on the railway was drawn for about four seconds to a whirring noise overhead, followed immediately by a heavy thud in the ground near them; and on searching in the direction indicated by the sound, they found the stone, about three minutes afterwards, at the bottom of a hole eleven or twelve inches deep, which had formed almost vertically through an inch of coke ballast and through thin growing turf and stony clay below at the foot of the slight embankment of the railway, four yards from the nearest line of rails, nineteen yards from the signal box of the siding, and forty-eight yards from the place where they stood when they heard the sound. The foreman narrated the occurrence, and placed the stone in the hands of the engineer of the Darlington district of the railway, Mr. Cudworth, in whose possession it now remains as property of the railway company; but it was submitted to me on March 25 for examination, and on Saturday, March 26, I visited the place of fall with Messrs. Cudworth and Ellinor, and the workmen under them, and with some scientific friends. A photograph of the site, and of the group of men finding the stone, has since been made, and steps are being taken for preserving the hole in the ground in a box fitted and screwed together round the earth about it, which will be thus bodily removed.

The stone weighs 3 lb. 8 oz. 83 grains, and is of a low pyramidal shape like an upper oyster shell, 3 in. thick and rather less than 6 in. x 5 in. in length and breadth. The interior is visible at points of the frayed edge and is gray, with very little interspersed grains of iron pyrites, and apparently no iron; and a magnet is not sensibly affected by the mass. Its specific gravity roughly determined is a little greater than 3·0. The flat back surface of the meteorite is covered with a rough brown crust, while the blunt conical front surface is deeply scored and furrowed radially from the center, and polished like fresh molten slag and of a lead-gray color.

The singular form and contour of the stone make it very desirable that, whatever provision is finally made for its preservation and mineralogical examination and description, it should not undergo more defacement from its original integrity than is absolutely necessary.—*Monthly Notices R. A. S.*

Lead in Bromide of Potassium.

Maschke has found bromide of potassium in the market which is contaminated with lead. It is soluble to a clear liquid only after addition of an acid; the larger crystals are remarkable by their transparency and their form, being a compound of octahedra and cubes. In testing for lead, sulphuric acid cannot be used, since the resulting sulphate of lead is soluble in bromide of potassium. But if hydrosulphuric acid or sulphide of ammonium is used, no doubt can arise.—*Pharm. Zeit.*

STEAM BOILER NOTES.

On the 14th of October a locomotive used for yard work on the Wabash, St. Louis, and Pacific Railroad was damaged by the explosion of its boiler while crossing the Mississippi River at Keokuk, Iowa. The forward part of the boiler was blown open and torn in pieces, the bridge was considerably damaged, and three men who were in the cab were slightly injured. The boiler has the reputation of being more than twenty years old. The engineer says it gave way while the water stood at the upper gauge cock, and under a pressure of 120 pounds of steam.

Perhaps he is right. Hundreds of boilers have done relatively the same thing. Doubts might arise in the minds of thoughtful practical readers as to the perfect condition of his safety valve, the accuracy of his steam gauge, by which the safety valve may have been adjusted, and the time that elapsed after his noting its indication and before the explosion. It is not necessary, however, in order to account for explosions of this class, to suspect that other conditions existed than those stated by this engineer. It is the result of natural laws and perfectly in accordance with practical experience that this twenty year old steam boiler should have acquired an obscure weakness of sufficient extent and so located as to allow a plate of its shell loaded with an internal pressure of nearly eight tons to the square foot to turn outward, as a door pressed by a high wind might burst open from steady depreciation of its fastenings, or as a flood-gate might give way when the rising pressure had overcome its resisting power. These similes are intended as illustrative of the manner of the breaking merely, and here the similarity ends, because the effect of the explosive expansion, the liberated water having a temperature of 138° Fah. above the atmospheric boiling point, is more like that of the burning of gunpowder than of winds or floods. The effects that follow its sudden release are similar to those that follow the firing of the powder.

On the morning of the 26th of October the engine of a freight train on the Indiana, Bloomington, and Western Road exploded its boiler just as it was starting from Champaign, Ill., with a freight train. The force of the explosion was downward, lifting the engine from the track and throwing it over. The fireman was fatally scalded and a brakeman hurt.

The boiler of a sugar house on John Dymond's plantation, at Belair, Plaquemines Parish, La., exploded November 24, completely wrecking the boiler house and badly wounding the following persons, who were taken to New Orleans by the steamer Daisey, and sent to the Charity Hospital: Joseph Meinker, foreman, leg broken and badly scalded, and Martin von Miller, Henry Clade, John McNorton, Edgar Batleye, Charles Creeland, and Ned Dunham, all badly scalded.

The October issue of the Hartford Steam Boiler Inspection and Insurance Company's circular contains the reports of their inspectors for the month of August, which shows that the total number of visits of inspection made during the month was 1,815, and the whole number of boilers inspected was 3,539. Of this number 1,289 were thoroughly examined both externally and internally, and 419 others were subjected to the hydrostatic test.

The whole number of defects found was 1,414, of which number 388, or nearly 28 per cent, were dangerous.

The detailed statement of the defects is given, which includes the notable items of 140 fractured plates, more than half of which were considered dangerous; 33 water gauges were defective; 18 safety valves were overloaded; and 121 steam gauges defective; while 40 boilers were found having no steam gauges whatever.

Although the modern steam gauge is now considered almost as much a necessity as the safety valve itself, yet it is questionable whether, as it is now often found telling a false story about the pressure in the boiler, it is not actually a dangerous appliance. It certainly should be kept in good order and be be of tentested, not only in its working range of indications, but above the limit, where it is very important that it should work freely. It is probable that the Hartford Company's inspectors rely upon the safety valves that have been adjusted by their own standard gauge, rather than upon such delicate and variable things as spring gauges. This is inferred from the fact that some of their risks have been continued from year to year on boilers having no pressure gauges at all. Time was within the remembrance of engineers now living when spring steam gauges were almost unknown. The safety valve was often consulted in those days, and was prompt to answer.

A New Variety of Glass.

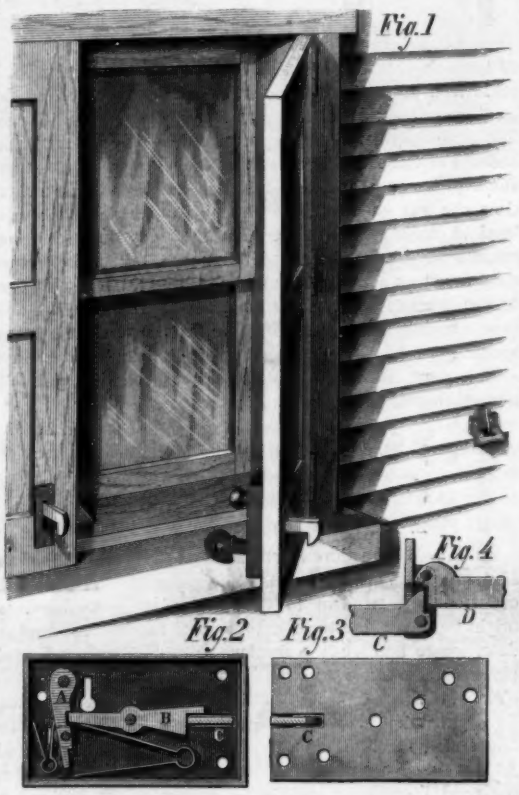
A Vienna chemist has recently discovered a new variety of glass. It does not contain any silica, boric acid, potash, soda, lime, or lead, and is likely to attract the attention of all professional persons on account of its peculiar composition. Externally it is exactly similar to glass, but its luster is higher and it has a greater refraction, of equal hardness, perfectly white, clear, transparent, can be ground and polished, completely insoluble in water, neutral, and it is only attacked by hydrochloric or nitric acid, and is not affected by hydrofluoric acid. It is easily fusible in the flame of a candle, and can be made of any color. Its most important property is that it can be readily fused on to zinc, brass, and iron. It can also be used for the glazing of articles of glass and porcelain. As hydrofluoric acid has no effect on the new glass it is likely to find employment for many technical purposes.—*Wiener Gewerbe Zeitung.*

IMPROVED SHUTTER FASTENER.

The engraving shows an improved fastener for blinds, shutters, and doors, which is so arranged that the inside catch for holding the shutter closed serves as a means for unfastening the outside catch from its wall loop. The inside catch can be locked securely with or without a key, but cannot be unlocked without the proper key.

Fig. 1 is a perspective view of a door, door frame, and a portion of the outside wall of a building, showing the improvement applied to the door; Fig. 2 is a view showing the locking bolt, pawl, and springs inside of the frame or case; Fig. 3 is an inside view of the back plate; Fig. 4 is a detail of the pivoted ends of the two catches and a part of the back plate of the case.

The frame or case of the fastening is composed of a rectangular box and a back plate. Inside of the case is a dog, A, provided with a spring, a locking bolt, B, and spring. The case has a keyhole and a slot for receiving the shank of the inside catch, C, and a slot for the neck of a knob or finger catch attached to the dog, A. On the back of the plate are two flanges to which are pivoted the inside catch, C, and directly above it the outside catch, D, as shown in Fig. 4. This catch extends through the shutter, and is designed for engaging with a wall loop and holding the shutter open. By raising the inside catch, C, the outside catch can be freed from its loop. The shank of catch, C, passes



AYER'S SHUTTER FASTENER.

freely through the casing, and has a loop for the finger, and a hook with a beveled nose to engage with the sill piece.

The bolt, B, is pivoted in the middle, and has a right angular notch in one end to engage with the shank of catch, C, as shown in Fig. 2, and safely lock this catch down.

The tapered end of the bolt, B, is designed to engage in a notch made in the edge of the dog, A, when the bolt, B, can only be moved by means of the key.

To unlock the bolt it is obvious that the key must be used, and when the bolt is held in an unlocked position to allow catch, C, to play freely, the tapered end of the bolt will be engaged by a shoulder near the free end of the dog. When the shutter is closed and the catch, C, is engaged with the sill piece by simply raising slightly the knob attached to the dog, A, the bolt, B, will lock the catch, so that it cannot be released from the sill piece except by the key.

This invention was recently patented by Mr. Henry B. Ayer, who should be addressed care of J. Hennessey & Bro., 123 Magazine street, New Orleans, La.

A New Steamship Project.—To Europe in Five Days.

A project is on foot in this city to establish a purely American line of fast passenger steamers to ply between New York and some port on the British coast. The plan, according to its projector, Mr. Jacob Lorillard, is to build ships which will take passengers from New York Monday morning and place them in London before Saturday night, making the trip from land to land in five or five and a half days.

Mr. Lorillard said to a *Times* reporter: "Our vessels will be 500 feet long, and will be built of steel to reduce weight. They will be provided with power three times as great in proportion to their displacement as is obtained by ships now afloat. These features mean speed. They will be divided into water-tight compartments, rendering them absolutely unsinkable. There will be fifty such compartments in each ship. That means safety. We shall carry no freight of any sort. We shall provide no accommodations for emigrants. Everything is to be in first-class style. Our vessels will be virtually floating palaces. What Pullman's parlor coaches are in the railway service our ships will be on the ocean.

"We shall build three ships to start with. Each ship will have accommodations for 500 passengers, and each will probably cost over $1,000,000, probably $1,250,000. As yet it is impossible to quote exact figures. The estimates we desire are not yet given us. We shall not run to Liverpool. Our landing place will be Milford Haven, in Wales, which is 200 miles nearer London than is Liverpool. Its harbor, too, can be entered on all tides. Upon this side of the ocean we shall save thousands of dollars yearly by the fact that we shall be able to escape wharfage assessments. Carrying only passengers, it will be our plan to anchor in mid-stream, as do men-of-war, and have shore communication by means of tenders. Lying off the Battery, we would be as easily accessible as are vessels at the city piers."

"When will you be ready for business?" asked the reporter.

"By the spring of 1883, but not before. Our vessels are yet to be built, and the greater part of our arrangements in other matters are still incomplete. But by the date I mention we shall certainly be in perfect readiness. Our success is assured so far as capital goes."

The line will be called the "American Express Line."

PROPOSED STORAGE OF LIGHTNING.

A correspondent suggests that Faure batteries be connected with lightning rods to accumulate the electricity of storms. In this way, he thinks, a vast amount of electricity might be stored for mechanical uses, "with results exceeding anything ever dreamed of in perpetual motion."

There are several objections to the plan.

In the first place an electrical condenser would be better adapted for the storage of the high tension currents developed in storms than the Faure battery is. The metal plates and acidulated water of the Faure battery would form so good a conductor for lightning that very little chemical work would be done in it; and it is this chemical work by the electric current which "charges" the battery, and thus prepares it for the subsequent redevelopment of electric energy under proper conditions. Experiments which we have made with the high tension currents developed by a Holtz machine show that such currents do have an appreciable effect upon the Faure battery, but the quantity of energy stored is comparatively very small.

By the use of condensers lightning might be stored, but such high tension electricity is as ill adapted for the operation of mechanical motors as dynamite is as a fuel for the steam engine.

Even if the sudden and violent energy of lightning could all be locked up by chemical action, and subsequently redeveloped in a quantity current, as in the Faure battery, the quantity of electricity to be had from storms is too small to pay for storage.

In one of his experimental investigations, Faraday determined that to decompose a grain of acidulated water an electric current powerful enough to keep red hot a platinum wire one one-hundred-and-fourth part of an inch in thickness, must be sent through the water for the space of three minutes and three-quarters.

This quantity of electricity he shows to be equal to 800,000 charges of a Leyden battery of fifteen jars, each containing 184 square inches of glass coated on both sides, equivalent to a "powerful flash of lightning." In other words the quantity of electricity involved in the lightning stroke—and it is quantity alone that is available for mechanical use—is very small.

In another connection Mr. Faraday demonstrates the fact that the electricity which decomposes a certain quantity of matter—a grain of water, for example—is exactly equal to that which is evolved by the decomposition of the same matter.

An ordinary galvanic cell, therefore, must evolve as large a quantity of electricity as would suffice for a respectable storm. For so small a quantity of electricity it obviously would not pay to set an expensive trap in the form of Faure batteries and lightning rods, even if the electricity of storms could all be captured that way. It would be vastly cheaper to generate the same quantity of electricity by means of galvanic batteries; and there are many cheaper sources of mechanical energy than the galvanic battery is.

Lead in Cider and Vinegar.

A recent report of the Connecticut State Board of Health mentions a remarkable series of cases of lead poisoning in Fairfield County, of that State. The source of the poison was finally traced to the barrels which the thrifty farmers had used for the storage of cider. The barrels had been used for holding boiled linseed oil. Some of the litharge (oxide of lead) employed in preparing the oil had been deposited on the inside of the barrels as a sedimentary coating, which the cider had dissolved. Obviously the proportion of dissolved lead was increased when the cider was kept long enough to turn to vinegar. In this case, as in so many others, the evil wrought by want of thought was serious if not fatal.

The Otto Gas Engines at Paris.

In the distribution of awards at the Exhibition of Electricity, in Paris, the Otto motor received a gold medal, the highest award given to machines of this class. As an indication of the success of these motors, it is said that over seven thousand of them have been put in operation during the past four years.

AMATEUR MECHANICS.

SOME THINGS IN BURNISHED BRASS.

The old and commendable fashion of making ornamental objects from solid hand-wrought metal is being revived to a wonderful extent. Steel, iron, brass, and copper are wrought into a thousand beautiful and useful forms, and the gilded and tinsel objects of recent days are now set aside for substantial and elegant solid cast and hand-wrought ornaments. It will require only a suggestion to set the amateur mechanic at work at this sort of thing, when his dwelling will soon be adorned with articles that will be the more valuable for having been produced at home.

Brass tubing and rods of round hexagonal and octagonal section, plain and perforated strips of different widths and thicknesses, half round and semi-hexagonal strips, and brass buttons, knobs, and nails of various shapes, may be purchased, so that the amateur will readily find available materials for the kind of work suggested. Half-inch square tubes, strips of brass half an inch by one-sixth of an inch, a few brass buttons, and a few knobs, are required for the easel shown in Fig. 1. The tubes may be draw-filed, then finished with the different grades of emery paper with oil, or they may be polished on an emery wheel, and the final finish may be imparted by using the finest French emery paper with oil.

When two tubes cross each other they may be halved together precisely as in wood-work, and may be fastened by soldering with soft solder.

When the end of a tube abuts against the side of another tube it may be fastened solid enough for all practical purposes by soft soldering by means of a blowpipe. Of course the joint may be brazed or soldered with silver solder, but as great strength is not required it is unnecessary to take that amount of trouble.

A very good way of fastening is to solder a plug in the end of the tube that abuts against the side of another tube, and to put a screw laterally through one into the plug in the other. In this case it is well to leave a slight feather on opposite sides of the abutting tube to engage the corners of the tube to which it is attached.

The scrolls should be attached by means of small screws. The panels consist of thin pieces of board covered with velvet or plush of any suitable color. They are inserted from the back, and are provided with a number of large convex nails. The support for the picture is movable up and down on the side pieces of the easel, and may be secured at any desired point by the milled screws.

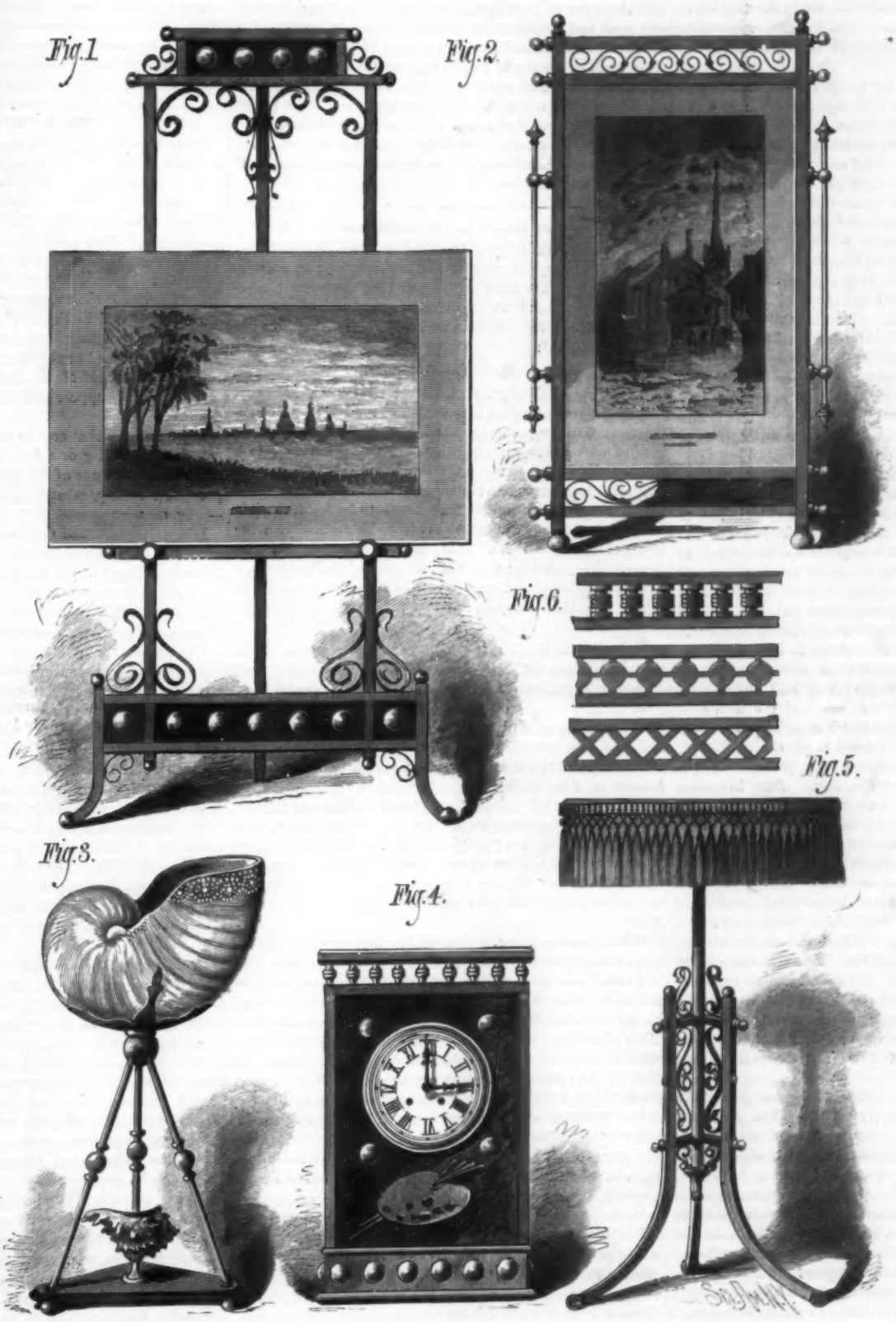
The frame shown in Fig. 2 will require no special description. The main portion of it is made of square brass tubing. The side bars are made of round brass rods with turned end pieces, as shown. The mat of thin wood is covered with velvet or plush. The picture and glass are placed behind the mat; the latter is provided with small brass ears, which are fastened to the back of the frame by screws. The knobs at the top, bottom, and sides of the frame and easel are turned and attached with solder.

Fig. 3 shows a tripod stand for a nautilus shell, with an ornamental shell placed below it in the center of the plate, forming the triangular base. Fig. 4 shows a clock case, consisting of an ordinary box of suitable size covered with plush or velvet, and inclosed in a frame of brass.

The frame is built up in the manner already described from square brass tubing split lengthwise through diagonally opposite corners. The lower portion of the frame consists of a wide band of brass, having a light bead soldered to its upper edge and a heavy bead soldered to its lower edge. A number of the brass nails are placed at regular intervals and soldered at the back of the brass base. The rail at the top is made of hexagonal brass tubing, and the small balusters are turned from brass rods. The palette and brushes are sawed from a plate of brass, and attached by tacks soldered to the back. The patches of color are produced by different colors of sealing wax. Four brass nails are inserted around the dial to relieve the blank spaces on the plush. The clock and its plush-covered case may be removed from the brass frame when it is desired to clean the latter.

The table shown in Fig. 5 is of the same general character as the other articles, and will not, therefore, need particular description. The central portion is of three-quarter inch round brass tubing. The legs are of five-eighth square brass tubing. The top is of wood, plush-covered and fringed, and provided with a border of perforated brass.

Fig. 6 shows different kinds of panels. The balusters in the upper one are turned in the two lower ones; they are cut from sheet metal.



ORNAMENTAL ARTICLES IN BURNISHED BRASS.

All of these articles may be lacquered, but they present a more elegant appearance if the metal is left unprotected and cleaned occasionally with rottenstone and oil.

There is hardly any limit to the number of elegant and useful articles that may be made of such materials, with the expenditure of little thought and labor. M.

NEW INVENTIONS.

Mr. Richard B. Ireland, of Trenton, N. J., has patented an improved switch signal. The object of this invention is to give notice of open or misplaced switches and drawbridges by an alarm on approaching engines, and thereby obtain security against accident additional to the usual signals. The improvement consists in the combination, with the switch-operating mechanism, of a turning dog located near the rails, and used in connection with a gong-operating lever on the engine.

Mr. John A. Hudgens, of Pine Bluff, Ark., has patented an improved hub, having a tapering metallic axle box provided with a circular shoulder near its inner end, against which the inner hub collar abuts when the wheel is put together. The portion of the periphery of the axle box which receives the hub collars or flanges and spokes, is made polygonal in form, and the remaining outer portion of the axle box is made cylindrical and screw-threaded on its outer surface to receive the nut which holds all together.

Mr. Augustus P. Nance, of Batesville, Ark., has patented a cotton cultivator by which several rows or drills of cotton may be cultivated at a time, whereby unnecessary expense of time and labor may be saved. The invention consists in two parallel horizontal beams, supported upon two double runners arranged near their ends, and a series of knives and plows which are adjustably secured to the two beams. The beams for general use will be about forty-four inches in length, and are secured to the tops of the runners and connected with each other by clips. The runners are so constructed that they will rest upon the ground only at their forward and rear ends, the intervening space being occupied by the knives and plows.

An improved grain-cleaning machine has been patented by Mr. Baxter Wright, of Marshall, Minn. This invention relates to certain improvements in grain-cleaning devices of that type in which one or more inclined sieves are provided with a series of check boards, which, reaching nearly to the sieve, retard the passage of the grain and facilitate elimination of the cockle and small seed, by causing them to pass through the said sieve, while the clean grain passes out at the end of the screen.

A valuable improvement in electric lamps has been patented by Messrs. Edwin M. Fox and Ludwig K. Böhm, of New York city. This improvement relates to electric lamps in which vacuum chambers are employed, and its object is to facilitate the insertion and removal of the carbon, as well as the operation of drawing the vacuum, and to dispense with the usual operation of sealing the drawing nipple by melting. For these purposes the invention consists in the

combination of a vacuum chamber formed with a neck and a sealing plug or stopper, having its longitudinal axis coincident with the longitudinal axis of the neck, and bearing the conducting wires; both the stopper and the neck being formed with openings arranged to be turned into or out of registration to permit the lamp to be first exhausted and then sealed.

Mr. James F. King, of Aubrey, Kan., has patented an improved cultivator shovel. In this improvement, the point of the shovel is securely held in position by causing it to form a beveled joint with the lower end of the upper plate, and backing the latter and the point, by a supporting plate riveted to the upper plate and bolted to the point, and the whole secured to the standard of the plow by a bolt passing through both plates. This forms a very strong construction of the shovel, and provides alike for the ready substitution of a new plow point when necessary, and for the replacement of either of the plates, or removal of the whole from the standard.

An improved water-indicating gauge cock device, which serves to indicate with greater accuracy the depth of water in the boiler, regardless of any deviation from a horizontal position of the boiler, has been patented by Mr. Joseph B. Snyder, of Montpelier, Ohio. The invention consists in a combination with a boiler, having a plate arranged to separate the water from the steam space of the boiler and provided with upwardly projecting steam distributing tubes, of a series of water gauges attached to pipes placed above and below said plate and extending about half way into the boiler.

Mr. George A. Deitz, of Denver, Col., has patented an improved method of preserving grapes, which consists in packing or embedding them in carbonized wheat bran or hulls, which substance has a disinfecting quality and tends to exclude the air and prevents its circulation, as well as maintains a comparatively even temperature. Grapes thus packed will be preserved a longer time and in better condition than when packed in other fine material commonly employed heretofore—such, for example, as sawdust, uncarbonized bran, fine cut paper, and kiln dried meal.

Mr. David W. Lloyd, of Pittsburg, Pa., has patented an improved metal lathing and furring. The invention relates to metal lathing and furring to be applied to ceilings or walls having iron girders for the purpose of holding the plaster, to which girders wooden laths cannot be applied, or to which it may not be desirable to apply wood on account of fire risks. The invention consists of metal furring strips applied transversely to the girders and having dovetail notches in their edges, with which are combined laths made of sheet metal bent into a dovetail shape in transverse section, said laths being slipped endwise into the notches in the edges of the furring, and being firmly held in a transverse relation therein, without nails or other special fastenings. This forms a very simple and secure construction and provides for the proper retention of the plastering.

An improved axle lubricator has been patented by Mr. Isaac N. Snedecor, of Gainesville, Ala. This invention relates to axle lubricators for railway cars in which the oil is conveyed from a reservoir beneath the axle to one above it by means of a suitable rotating device attached to the end of the axle. Therefore, in lubricators of this description, a slight longitudinal oscillation of the axle has been sufficient to strain or displace the rotating device, and the supply of oil has usually been more copious than necessary. The present improvement obviates these defects, besides being otherwise advantageous. It consists in a brush wheel fitted on a pin in the end of the axle so as to rotate with it, and held up against the end of the axle by a spring, but capable of movement along the pin. The brushes on this wheel strike a pin in the upper reservoir to discharge the oil, and a diagonally grooved box distributes it over the bearing.

Mr. Albert C. Ellithorpe, of Chicago, Ill., has patented a very efficient safety device for elevators. The invention generally consists in a combination, with an elevator car provided with a brake mechanism, of an auxiliary air shaft, a cage moving up and down within said shaft and provided with an upper and lower valve operated by the resistance of air in the shaft, and a connection between the cage and elevator car adapted to be broken or detached by the resistance of the air when an accelerated speed is imparted to the car either from breakage of the lifting rope or other cause. In the event of the elevator car moving with too great velocity downward, a corresponding increase of velocity is imparted to the cage upward, and the resistance of the air in the shaft causes the valves in the cage to prevent air contained in the upper closed portion of the shaft from passing the cage, thereby producing a strain on the cage which breaks its cable and causes the brakes on the car to be applied. A valve at the bottom of the shaft, opening upward, admits air to prevent a vacuum when the cage is moving upward, and assists in establishing an air cushion when the cage descends too rapidly.

Mr. Peter D. Graham, of Black Hawk, Col., has patented a combined calipers, rule, and beam compass. In this invention the calipers are formed with an arm extending backward from the joint which unites their legs. The outer end of this arm is formed or provided with a pointed extension which may be used as one of the legs of a beam compass by screwing the extension arm of the calipers on to a screw-threaded reduced portion of the end of a measuring rule, a sliding scriber or leg with caliper attachment being fitted for adjustment on the rule to complete the beam compass. By removing the calipers from the rule, then they and the rule may be used separately, and the pointed extension of the calipers' arm, when made detachable, may be used as a scratch awl. This makes a convenient combination of several instruments used in the same trade.

Mr. Henry H. Thorp, of New York city, has patented a valuable improvement in types for curved or sloping-line work. In ordinary types the letters are formed on bodies of irregular widths bearing no special proportions to each other; hence, when set up in curved or sloping lines they cannot be justified with the ordinary quads that are used in straight-line work, accordingly the work of setting types of the ordinary construction in curved or sloping lines is very tedious. The object of this invention is to produce, with types in position, curved and serpentine lines by casting the faces of some of the types in different positions on the type bodies and the types of runningwise widths that are multiples in one way and fractions in another of certain units. The invention consists in forming the type bodies according to their faces or letters of runningwise widths that are multiples of a measure of which the width of the body having the narrowest letter represents the unit, the wider type bodies being cast or formed of runningwise widths increasing regularly in eighths, quarters, or other regular multiples of the unit, these widths of the type bodies being also fractions of their bodywise heights.

The Origin of the Guillotine.

The *Journal* has frequently called attention to the SCIENTIFIC AMERICAN, not only as a paper specially devoted to science, but as a weekly newspaper that abounds in what may be styled the cream of interesting general news.

In the SCIENTIFIC AMERICAN of November 5 the following item is published:

"A MEDIÆVAL GUILLOTINE.

"The Chapel Bridge, at Lucerne, contains a mediæval painting representing the persecution of the Helvetian Christians under the pagan emperors of Rome. On the right side of the picture a number of Christians are being hurled into a river, perhaps the Reuss. On the left side a very evident guillotine is erected; one Christian lies with his head on the block, and the huge iron is just about to be let drop upon him, while a number of headless bodies lie around with the heads close beside them. It is commonly believed that this decapitating machine was the invention of Dr. Guillotin, a French physician, and member of the National Assembly of 1789. The Lucerne painting was made at a much earlier date."

According to Gibbon, the most severe persecution of the Christians occurred toward the close of the reign of Diocletian, who reigned twenty years, and resigned on 1st May, A.D. 305.

The painting at Lucerne probably refers to the persecutions of this period, when many of the Christians were beheaded; and this would, therefore, appear to be the earliest indication of the guillotine.

In Camden's "Britannia," translated by Edmund Gibson, and published in 1695, a large folio of over 1,200 pages, written by Camden nearly three hundred years ago, and devoted by him to what was then the antiquities of England, on pages 726 and 727, the following interesting description of the guillotine will be found, under the account of Halifax:

"But nothing is more remarkable than their methods of proceeding against Felons; which, in short, was this: That if a Felon was taken within the Liberty with Goods stolen out of the Liberties or Precincts of the Forest of *Hardwick*, he should, after their Markets or Meeting days within the town of *Halifax*, next after his apprehension, be taken to the Gibbet there, and have his head cut off from his body. But then the fact must be certain; for he must either be taken *handhabend, i. e.*, having his hand in, or being in the very act of stealing; or *backberond, i. e.*, having the thing stolen either upon his back, or somewhere about him, without giving any probable account how he came by it; or lastly, *confesson'd*, owning that he stole the thing for which he was accused.

"The cause, therefore, must be only theft, and that manner of theft only which is called *furtum manifestum*, grounded upon some of the foresaid evidences. The value of the thing stolen must likewise amount to above 13 *d. ob.* for if the value was found only so much, and no more, by this Custom he should not dye for it.

"He was first brought before the Bailiff of Halifax, who presently summoned the Frithborgers, within several Towns of the Forest; and being found guilty, within a week, was brought to the Scaffold. The Ax was drawn up by a pulley, and fasten'd with a pin to the side of the Scaffold. If it was an horse, an ox, or any other creature, that was stolen; it was brought along with him to the place of execution, and fastened to the cord by a pin that stay'd the block. So that when the time of execution came (which was known by the Jurors holding up one of their hands) the Bailiff or his Servant whipping the beast, the pin was plucked out, and execution done. But if it was not done by a beast, then the Bailiff or his Servant cut the rope.

"But the manner of execution will be better apprehended by the following draught of it."

Immediately following there is shown on page 727 a picture which is in itself a curiosity, showing:

"A. A. The Scaffold.

"B. The piece of wood wherein the Axe is fixed.

"C. The Axe.

"D. The Pully by which the Axe is drawn up.

"E. The Malefactor who lyes to be beheaded.

"F. The pin to which the Rope is ty'd that draws up the Axe."

The foregoing extracts are copied by word, by letter, and punctuation, according to the text, by which it will be noted that the important nouns are spelled with a capital letter; that Ax is spelled both with and without an *e* at the end; that the word horse has *an* prefixed; that die is spelled *dye*, and *'d* for *ed*, etc.

The title of this imposing and interesting work is "Camden's Britannia, newly translated into English, with large additions and improvements, published by Edmund Gibson, of Queen's College, in Oxford," and this description of the guillotine is one of the "additions" by the translator. The original work was first published in Latin about the year 1586. In twenty years this important work went through six editions, the result of twenty years of personal research in almost every county in England. The translation by Gibson was published in 1595.—*Bucyrus (O.) Journal.*

The Duration of Life.

From a paper read before the Investigators and Physicians, at their Salzburg meeting, by Weismann, the *Chemiker Zeitung* makes the following extracts:

In the first half of his address the speaker endeavored to show that the very great difference in the duration of animal life did not depend solely upon the anatomical and physiological proportions of their bodies (size, complicate structure, early maturity, etc.), but that it depended far more upon the exact accommodation to its conditions of life in the different species, and that in the course of the formation of new species corresponding to changes in the conditions of life it may be lengthened or shortened.

The second half of the paper discussed the manner in which we may suppose such an accommodation to the conditions to exist.

If we inquire what are the mechanical changes which may cause a lengthening or a shortening of the duration of life, it will lead us to one of the most difficult of all physiological problems, namely, what is the reason of death taking place—why must an animal die?

It is well established that in the higher animals the vital processes are combined with a change in the morphological elements of most of the tissues, and it is but natural to seek for a cause of death in a limit to the multiplying power of the cells, which does not, of course, exclude the idea that death may occur much sooner too.

Upon this hypothesis it would follow that there is a certain normal number of cell generations for each species (although varied within wide limits), and that the maximum length of life is governed by this. We do not comprehend why one cell must divide or segment itself ten times, a thousand times, or a hundred thousand times, and then the process should cease. This subdivision and segmentation, from a physiological standpoint, could continue for ever.

It is only by considering it from the utilitarian standpoint, upon the ground of expediency, that we can understand the necessity of death, and the same ground favors the utmost shortening of life. The individual by contact with the outer world around becomes worn and used up, so that it would be indispensable that it be replaced by new and more perfect ones, even if it contained within itself the power of living on for ever.

It does not, however, follow from the expediency of death that internal causes, lying in the very nature of life itself, should be excluded, as, for example, the floating of ice on water is expedient (answering a purpose), but at the same time depends upon its molecular structure.

Still Weismann does not believe that a definite limit has been set upon life simply because it, from its very nature, could not be endless, but that it is limited *because the unlimited duration of the individual would be an inexpedient luxury*, and he considers death to be a phenomenon of accommodation. The power of living for ever has been lost because it was no longer necessary.

Death is not an attribute that belongs to all organisms; there are many of the lower organisms which, although they can be destroyed, are not compelled to die. In the division of the amœbæ we cannot call it death, for where is the corpse? Let us suppose an amœba to possess consciousness; it would then on dividing say to itself: "I have cut off from myself a daughter." I do not doubt that each half would think that the other half was the daughter, and would look upon itself as the original individual.

If, then, death is necessary for the higher animals, why not for the lower? Are they not decimated by their enemies? Do they suffer no defects? Do they not wear out? In the lower organisms there is but one alternative: complete integrity or total destruction; they cannot suffer a normal death because the individual is identical with the propagating cell. In the multicellular organisms there are different kinds of cells, so that death is possible, and we see that it follows.

The kind and quantity of propagation does not depend merely upon the nutrition of the cells, but also upon their specific nature, as seen most distinctly in the phenomenon of inheritance, and it is a necessary sequence of this view, if we look upon death as foreordained, because it is the inherited end of that segmentation process whose beginning was the sulcation. (Cells multiply by subdivision, but before this takes place they become furrowed, or *sulcated*, at the point where division subsequently takes place.)

C. Z.

MECHANICAL INVENTIONS.

Mr. John G. Carnahan, of Oxford, Ind., has patented an improvement in stem-winding watches which is both simple and efficient. The invention relates to that class of stem-winding watches in which the winding and hand-setting mechanism is engaged with the gearing for winding up the mainspring and the gearing for setting the hands by the longitudinal movement of the stem. In the present invention, when it is desired to set the hands, the stem is first drawn out, which causes a collar on the inner end of it to bear on a stud in the shorter arm of a two-armed curved lever and so depress the long arm of the latter, which turns a yoke and disengages the gearing from the mainspring arbor, and connects an independent wheel with the hand-setting train to which motion is imparted by turning the stem. As soon as pulling on the stem ceases the yoke is thrown back to its place by a spring. Normally another wheel, carried by the yoke, meshes with the arbor wheel of the mainspring, and is thus always ready for winding by pressing down upon and turning the stem.

An improved cotton gin has been patented by Mr. Joseph Kopfler, of Amite City, La. In this improved gin the power is applied by band and pulley to the saw shaft, and the brush cylinder which operates in connection with the saw is driven by frictional contact of pulleys fast on the shafts of the saw and brush cylinders. To vary the pressure of these pulleys one upon the other, and to relieve them from contact when required, the bearings of the brush shaft are adjustable by means of a cam lever. This not only provides for wear of the driving surfaces of the two pulleys, but saves much wear by readily permitting of the stoppage of the brush cylinder. Combined with the brush cylinder is a picker to straighten the fibers of cotton passing through the gin. This picker, which is armed with rearwardly-projecting spikes that are swept by the brushes, is driven by band and pulley from the saw shaft, and is partially inclosed by a shield which is constructed so as to present no salient angles to interfere with the brush in its revolving movement.

Messrs. Stillman W. Robinson and Lewis C. Kiser, of Columbus, O., have patented an improved air compressor. The frame of this machine is of triangular form, containing the air receiver within it and having four cylinders arranged at the corners of it, two of which are for air and two for steam, and a single shaft located at the apex of it. This shaft is provided at its opposite ends with cranks, each of which is connected with a pair of eylinders at one end of the compressor, which cranks are arranged to secure equalization of power and resistance. Such arrangement of parts is both compact and efficient. In this arrangement, also, two connecting rods are combined with a single crank by means of a block rigidly connected to one of the rods and turning upon the crank pin, and carrying also the joint pin for the other connecting rod, whereby frictional resistance is reduced. Furthermore, the air cylinder and eduction pipes have combined with them pockets containing the induction and eduction valves and passages, which pockets are made detachable and interchangeable to facilitate repair.

Mr. Christopher Lewis, of Columbus, Ohio, has patented an improved continuous rolling mill. This invention relates to mills for rolling rails, girders, plates, etc., and its object is to permit more rapid working and to reduce the manual labor ordinarily incident thereto. The invention is an improvement in that class of rolling mills in which several pairs of rolls have their alternate pairs arranged to be run in reverse direction to those next adjacent, and in which a laterally adjustable carriage takes the rail and transfers it from one pair of rolls to the next, so that it is passed through one pair of rolls in one direction and is returned through the next pair of rolls in the reverse direction. The invention contemplates the taking of a piece of steel from the furnace in the shape of a bloom and entering it between the first pair of rolls, whence it proceeds on through the machine without handling and comes out a perfect rail; and to this end the improvement consists in combining the series of rolls whose alternate pairs have a reversed movement with a set of carriages of constantly increasing length, a set of tracks for carrying them from the line of one pair of rolls to the next, and a corresponding set of piston rods and steam cylinders grouped together at one side of the machine, which piston rods connect with the carriages to shift them at the will of the engineer in charge. The invention also comprises means for causing the ingot or unfinished rail to be fed forward to the rolls after the carriages bring them successively into line with the rolls; and also means for turning over the article being rolled to suit the different positions in which it may be required to be passed through the rolls.

Mr. James A. Bonsack, of Bonsack's, Va., has patented an improved cigarette machine. This invention is an improvement upon a previously patented machine by the same party, and which comprised a combination of a concave with suitably covered rollers, and also a reciprocating belt for distributing and spreading the tobacco for a uniform and homogeneous feed, also a peculiar tapering tube having an endless belt passing through it for receiving the tobacco and causing it to be curled up longitudinally to form a filler, likewise a second endless belt, that carried the filler and a strip of paper through another tube that wrapped the paper around the filler and held it while being pasted. The present invention consists in a combination with a toothed distributing roller and a double concave, of a toothed roller at the entering side of the concave, for co-operation with the latter, to feed the stock to the distributing roller and prevent it from piling up on the outside. It also comprises a brush at the delivery end of the spreading belt and its reciprocating frame, for preventing the adhesion of tobacco to said belt; likewise a toothed belt operating in combination with toothed and plain rollers, to prevent piling; also a pressing roller for forcing the tobacco down between the teeth of the belt before passing beneath the concave; and a trough-like device for forming a continuous filler, composed of three endless belts and a pressing contrivance, backing strips applied to said belts, and pulleys for distending the latter. The invention also includes a holder for the cigarette and means for projecting said holder and the cigarette during the operation of cutting the latter.

Mr. John H. Munson, of New York city, has patented an improvement in button-hole sewing machines. The object of this invention is twofold, namely, first, to avoid the inconvenience and expense of the breaking of the friction spring which bears on the carrier plate of a button hole sewing machine, to hold said plate steady during the movement of it, which breakage has been due to the gradually increasing pressure as the work advances; and, secondly, to apply the requisite friction to the carrier plate before the sewing commences, and thereby avoid that unsteadiness of the carrier plate and irregularity of the sewing at the commencement of the button-hole, which takes place when the friction spring is fitted so that it does not touch the carrier plate till after the sewing has commenced. To these ends the invention consists in a friction arm pivoted to the bed plate, and bearing at its free end on the sliding carrier plate, by the action of a spiral spring contained in a socket that is fixed on the bed plate. This arm is so arranged that it bears on the carrier plate in a direction at right angles to the first or straight movement of said plate, so that the spring acts before the sewing commences. Said spring is arranged around a pin pivoted to the under side of the friction arm, and is held between a flange on the pin and the bottom of the hole in the socket. By this construction the required pressure can be obtained without risk of breakage, and the proper working of the machine is facilitated.

Live Millers.

The title chosen for this article is an American phrase, but not the less expressive on that account. We have certainly no desire to aid in the Americanizing of our institutions or our language, but we should be very happy if, to any extent, we could be instrumental in infusing into the minds of the millers of the United Kingdom some portion, and the more the better, of that energy which the Americans inherit from ourselves, and which, greatly to their credit, they have improved upon. The phrase is used by our brethren across the Atlantic not as expressive of vitality in the ordinary physical sense, but as indicative of the possession of a keen sensitiveness to all the influences which affect the trade with which they are identified, and a lively appreciation of the varied circumstances which, at any and all times, go to the promotion of its interests, or which may militate against them. That all the American millers are "live" in the specific sense referred to cannot, we suspect, be affirmed, for "Sleepy Hollows" still exist in that favored region of the world, just as they did when poor, simple, henpecked, ne'er-do-wellish RipVan Winkle took that memorable "nap" of his. There are, however, a very large and constantly increasing number of millers in the United States who are "live" in the strictest sense of the term as the Americans use it.

To how many of those in the United Kingdom can it be applied in a sense equally strict? We are happy to think that their number is large, and that within the last few years their liveliness has been getting more robust, while their numbers have been gradually increasing. There are indeed few millers in the country who are not "live" in the sense of looking after what they conceive to be their true interests. They strive to get the best price they can for their flour, and to obtain the raw material of their manufacture in the cheapest possible markets. They entertain thoroughly orthodox views on forward sales and long credits, although, after the manner of human nature generally, their practice in these particulars occasionally gets the better of their theoretical principles, much to their loss. They have a virtuous horror at anything savoring of laxity in the due return of sacks, and in commercial matters they have the fullest assurance that they know how many beans make five.

To be a thoroughly "live" miller in the present day, when forces have to be contended with which up to within a few years were, if not actually non-existent, so quiescent as not to disturb the steady current of the trade, requires the possession of other and higher attainments than those necessary to shield the members of the trade from the pitfalls of forward sales, long credits, and sack keepers. To be thoroughly "live," a miller at the present time must have the fullest appreciation of the changes which have taken place in the circumstances and conditions of the trade, not merely in his own country, but in every country where milling ranks as a chief industry. The history of our cotton manufactures shows how fortunes were made, and the wealth of the country increased by the skill of our manufacturers and operatives in utilizing the raw material of the Southern States of America, and selling the manufactured products to Americans and other nations. It is *not at all likely* that our millers will attempt to do with wheat what our Lancashire millowners did so successfully with cotton; but it need not be said that it is necessary that they should keep themselves thoroughly *au courant* with reference not only to the price of wheat in the various wheat-growing regions of the world, but with the conditions under which it is cultivated, the natural enemies with which it has to contend during its growth, the average surplus of the material which the different countries have at their disposal for export, the facilities which exist for its transportation to our markets, and the rates at which transport can be effected.

The "live" miller must be a diligent reader, in order that his mind may be stored with facts bearing upon his trade in all its departments. Reading is, in a very special sense, the bread which sustains his vitality in a trade aspect, and if it is not systematic and sustained, but by fits and starts, to fill up an unoccupied hour or pass an evening which hangs heavy on his hands, his vitality will suffer.

In order fairly to appreciate the changes which have been effected on the circumstances and conditions of his trade, the miller to be really "live" must have recourse to reading, because, as a rule, he cannot devote the time which would be necessary to acquire the requisite knowledge at first hand. Even supposing this could be done, he would require to be constantly on the move to keep his information abreast o. the progress which is now going on with such rapid strides that the novelty of this year stands a great chance of being obsolete next. Books, and more especially the journals devoted to his trade, which photograph every step of the progressive march, are his towers of observation, from which, without leaving the precincts of his study, and incurring the expense, the fatigue, and the dangers incident to long and frequently repeated journeys, he can scan the entire field of milling practice and ascertain how and in what respects that of his foreign rivals differs from his own. Possessed of this knowledge, the "live" miller feels his vitality quickened, and as he studies the means used by his rivals for the purpose of securing the results they severally desiderate, he becomes conscious of an accession of energy which enables him to adopt measures of combating their rivalry with, at all events, a fair certainty of success.

The motto of "live" millers is "Never say die." They feel that what is possible for others can always, at the very least, be attempted by themselves. If they become convinced that they have been pursuing a wrong course, they console themselves with the comforting proverb, "It is never too late to mend." If wrong, they had, up to the other day, the entire trade for company, and being readers, they know at what precise point they discovered that a new path had been opened up, which was declared to be the only right and safe one, and they have sufficient data to enable them to decide, with some approximation to correctness, what degree of truth there is in the allegation. It is the "live" miller only who has the wisdom to know when he is wrong and the courage to take the requisite steps to put himself right, if he possibly can.

Although "it is never too late to mend," he does not defer the reformative effort a moment after he is convinced that amendment is indispensable. He may—for is he not human?—have a lingering affection for the path he has traveled in so long, and with much comfort and profit to himself, just as one has an affection for the old suit of clothes, which has almost become part of one's self, rather than for brand-new garments, which suggest no higher or more tender ideas than the tailor and the tailor's bill; but he screws his "courage to the sticking place," and discards the well-worn paths, just as he lays aside—perhaps with the sentimental tribute of a sigh—the well-worn garments. He cannot afford to gratify prepossessions which tug at his heart to the detriment of his purse, and although the music of the mill stones may be sweet to his ears, he throws them aside the moment his commercial sense is convinced that rollers or dismembrators are means for the production of flour for which there will be a larger demand and a higher price than for that produced by mill-stones.

"Live millers," so far as trade matters are concerned, obey the dictates of science rather than those of sentiment. For them the age of faith is no longer existent, and however positive may be the dogma and venerable the dogmatist, they insist on the subjection of both to the crucial test of investigation. They object to nothing merely because it is new, and they discard nothing because it is old. "What can it do?" is their question to anything recommended for their acceptance, and if the answer is demonstrably satisfactory, acceptance is the result. They are pre-eminently anti-rule-of-thumb men, but they are equally impatient of scientific theories until they have been proved to harmonize with sound and profitable practice. They have no objection to spend money in trying experiments if these give *prima facie* promise of success, but they have a very decided exception to "leaps in the dark," which in most cases result in loss of time and loss of cash, a double waste for which there is no recompense. "Live millers," in fact, are men of sense as well as men of science, who take a pride in their trade, not only as it is the method of making, if not in all cases fortunes for them, but fair competences; they also take a pride in it as a means of bringing the higher powers of their mind into that healthy play which yields the highest form of enjoyment which reasonable men can desire. They no doubt regard their mills as money-making shops, but they also contemplate them in another aspect, viz., as establishments in which processes are carried forward related to the manufacture of a material which constitutes the most important factor in the alimentation of civilized mankind.—*London Miller.*

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) G. D. wants to know what is meant by the term 10 lines, 16 lines, 17 lines, etc., used in connection with watches and telescopes? A. A line is one-twelfth of an inch, and is usually employed in measuring the diameter of lenses, watch glasses, etc.

(2) W. and D. ask: How will it be best for us to attach two engines of unequal size to a counter shaft, each to have only its share of the load at varying strain, such as saw mill work? The engines are 7x10 and 8x12; each has its own boiler and will carry different pressures of steam—say 80 and 100 lb. steam pressure. A. All that is necessary in this case is to proportion the driven pulleys so that when the shaft to which they are attached revolves at its regular rate, the driven pulleys will have the same peripheral speed as their respective driving wheels when running at their normal rate.

(3) L. D. S., of Ill., says: I have just put an iron force pump in a well, on a galvanized iron pipe. Was recommended to use the galvanized iron, so as to prevent the iron from rusting and giving a taste to the water. Now I am told by parties who appear to have some knowledge on the subject, that the galvanized iron is poisonous. Will you be kind enough to give your advice on the subject through the SCIENTIFIC AMERICAN? What kind of a stock or pipe would you attach to an iron force pump? A. The safest pipes are those of plain iron. Galvanized iron pipes should not be used for conducting drinking water, as the zinc dissolves and the water containing it is poisonous. We have heretofore published accounts of fatal results from the use of such galvanized iron pipes in the vicinity of Boston, Mass. In the case of our correspondent perhaps the length of his pump pipe is so small that bad results would not ensue, provided care is taken not to use the water that has been standing for any length of time in the pipe.

(4) R. E. E. asks: How can a round stick, 1 inch in diameter, 3 feet 7 inches long, be bent on a circle the diameter of which is 38 inches? We have tried to bend them of ash, but one-third breaks in bending. We want to make them of beech and birch. Can you inform us how we may bend them without breaking? A. Submit the wood to the action of boiling water for twelve hours, then bend over a suitable form, and clamp in position until dry.

(5) J. A. P. asks: 1. Is there any cheap mode of roughing iron or steel so as to make its surface resemble that of very fine emery paper? A. It may be done by etching, by first stippling the surface with wax or some other protective coating. A sand blast would probably be cheaper if the steel were required in any quantities. 2. In what way can I coat a metal rod with rubber? A. Dip it in a solution of rubber in bisulphide of carbon, or wrap with raw rubber, and vulcanize. You can also do it by coating the rod with cement and drawing over it rubber tubing.

(6) B. T. H. asks: Is the quantity or intensity current required to work a telegraph line with metallic circuit of 600 feet in length, with two instruments? A. It depends upon the resistance of the magnets of the instruments. If they are of low resistance use a quantity current.

(7) W. W. asks: Does any action on the zinc in the gravity battery take place when the circuit is broken? A. Yes; there is more or less local action.

(8) W. M. asks: Can you give a good receipt for a cement to glue cloth to wood? I want to put a new cloth on my library table. A. See Cements, page 2510, SUPPLEMENT No. 158.

(9) J. W. J. writes: In preparing a Faure secondary battery, should the red lead be allowed to dry before the strips are rolled into a coil? A. No.

(10) S. L. G. asks: 1. How many feet of pipe, twelve feet long and two inches inside diameter, will be required to obtain eight horse power, the water to be in the pipe and the pipes in the flame? A. If pipes are twelve feet long, you will require twenty-four pipes. 2. How thick should the pipes be to allow a margin of 50 per cent for safety? A. Ordinary lap-welded water and steam pipes are amply strong. 3. I want the pipes to be horizontal. Would bridges be necessary to prevent sagging. A. If horizontal they should have a central support; but placed horizontal the steam formed cannot readily escape, and if the heat is strong there will be risk of burning the pipes. 4. At what temperature does water boil in half an atmosphere? A. 180° Fahrenheit.

(11) J. B. H. says: I have some plaster casts of jaws and teeth which I wish to duplicate. It is very difficult to do this in plaster. Is there not some elastic gelatine compound which will take the shape and pull off, which will answer as a matrix? A. Gelatine moulds are prepared from glue and glycerine. Digest good glue over night in just enough cold water to cover it, and dissolve this by aid of heat over a salt water bath in a quantity of concentrated glycerine equal to that of glue taken. Continue the heating for half an hour, then pour into pattern. The outside of these moulds may be rendered non-absorbent of water by dipping them in solution of one ounce bichromate of potash in one pint of water, and exposing for half an hour to strong sunlight.

(12) D. R. writes: I heat my office with live steam from the boiler, and have to carry it some fifty feet or more in pipes overhead through a part of the mill where heat is not needed and where the air is very cold owing to the outside doors being more or less open all day, and I find the steam condenses a great deal in passing through this cold room. I want something to cover them with that will prevent a considerable of this condensing. I want something that I can mix up and put on myself. Would common clay, put in a wooden box, answer? A. Perfectly dry sand may be employed advantageously in the way you suggest. Coal ashes answer very well.

(13) C. H. W. asks: What would be the effect of forcing a succession of charges, one at a time, into the cylinder of any of the different forms of explosive engines (as the Otto gas engine or the Brayton oil vapor engine), and exploding each charge by itself and preventing any escape of the gases resulting from the explosion? 1. Would the pressure accumulate and prevent the explosion of the charge? A. The pressure would have little effect upon the explosibility of the charge under the circumstances. 2. Would the pressure increase and cause the gases resulting from the explosion to condense? A. The gases produced would condense.

(14) J. K. writes: I send this day some specimens of ore. Please state in SCIENTIFIC AMERICAN what minerals they contain, if any, and whether they are worth an assay, and also what minerals such looking stone indicates? A. A calcareous trap rock; contains no minerals of value.

(15) T. and H. ask: Can you give me a receipt for a cement for securing rubber to cast or malleable iron that will stick hard, also that can be washed in hot water without injury? A. Try the following: Melt together in an iron pot equal parts of gutta percha and shellac. Apply hot. See other receipts on page 2510, SUPPLEMENT, No. 158.

(16) H. W. B. writes: In your issue of November 19, you give an article on poison. A friend and I, to decide a dispute, are anxious to ascertain the shortest time that twenty grains of cyanide of potassium will kill a person in—that is to say, how soon he will be absolutely dead. A. Under ordinary circumstances insensibility and death would probably take place within ten minutes after the poison had been swallowed. The action of the poison is rarely delayed more than a few minutes.

(17) R. M. says: In this week's Notes and Queries (No. 25), E. J. D. wants to know if hot water will kill the scale bug on his orchard trees. If he will get linseed oil (boiled) and paint it over the trunks and the larger limbs, and as much as convenient on the smaller branches, he will effectually kill this pest and do the tree much good besides.

(18) E. M. says: Referring to your answer to E. M. (3), page 330, current volume (receipt for liquid shoe polish), it should read 1½ lb. of shellac instead of ounces. I have tried it, and found that with this quantity (1½ lb.) of shellac it makes an excellent dressing for shoes, and looks well on iron if the latter is not liable to be too strongly heated. It will not stand freezing.

(19) F. R. G. asks: 1. What is the size of the induction coils used in connection with the telephone? A. In the Blake transmitter the coil is about 2½ inches long, 1¼ inches diameter, with a ¾ core, consisting of a bundle of fine wires. The primary wire consists of four layers of No. 24 wire. The spool is filled with No. 36 wire. 2. What sizes of wire are generally used? A. In the Edison transmitter the coil is much larger, being about 4½ inches long, 1½ inches diameter, with a 1¼ inch core of fine iron wires. The primary consists of four layers No. 18 wire, the secondary is of No. 34 or No. 36 wire.

(20) A. G. asks: How is japanner's gold size prepared? A. One gallon of linseed oil is boiled in a capacious pot for two hours; eleven ounces each of dry red lead and litharge and five ounces of copperas is then gradually sifted in while the oil is kept hot and constantly stirred from the bottom up. When the oil has been boiling about three hours, and the driers are all in, add two pounds of gum anime, previously fused and mixed with three and a half pints of raw oil, and continue the heating and stirring for about five hours, or until it hangs in strings from the ladle yet drops in lumps. Let the contents of the pot cool down somewhat, then mix it with three gallons of oil of turpentine (away from any flame or fire). This gold size ought to dry in fifteen minutes or less under favorable conditions. It improves by keeping when properly prepared.

(21) W. H. H. asks: By what process are the plumes of pampas grass colored the various colors? A. The aniline or coal tar dyes are employed for this purpose. Use a hot dilute solution in water (or water and spirit) of the appropriate color. A bath of tannin in water before dyeing renders the substance more easily and perfectly colorable. For red or reddish shades an after-bath of chloride of tin is frequently employed to bring out the color.

(22) S. H. asks: How much copper steam pipe surface is required to evaporate 2,400 pounds of saturated salt water per hour? A. About one thousand cubic feet of surface, with steam at 25 pounds pressure.

(23) E. T. S. asks: What will remove the ink put on the page of a book by a rubber hand stamp four years ago? It is both blue and red, and is an aniline ink. I have tried sulphuric, nitric, muriatic, acetic, oxalic, tartaric, and citric acids, and they are no go. A. Try the following: Digest half a pint of water with three-quarters of a pound of fresh chloride of lime (bleaching powder) for several hours; then draw off the clear liquid and mix it with about one-fourth its volume of strong acetic acid. The solution can not be kept for any length of time.

(24) J. S. W. asks: What kind of sizing will hold gold bronze on paper and bristol board so the bronze will not rub off? A. Bronzing gold size is japanner's gold size (see answer to A. G.), kept till very bright and tough from age, and then mixed with a little (about 10 per cent) of very old carriage varnish.

(25) J. P. M. says: We draw our water supply for our boilers from the river, and the water has oils and acids mixed in it from the mills up stream. Can you suggest any way to obtain relief from the oil or the acids? A. You might draw your water into tanks, let it settle for a few hours after filling them tap twelve inches above the bottom of the tanks, letting the water pass slowly through a barrel filled with coarse and fine gravel and limestone or marble, the water passing in at the bottom and flowing out of the top of the filter.

(26) F. M. writes: Will you please be good enough to decide the following question: Which has the most power: an engine 12x20, or an engine 12x24, steam 80 lb., other things being the same in both; the piston running the same number of feet per minute on each? A. The difference in useful power yielded by a 12 inch by 24 inch, and that by a 12 inch by 20 inch steam engine, each making the same piston speed, using steam at the same initial temperature, pressure, and saturation, and expanding (including ports and clearances) in the same ratio, will not be perceptible in practice. Experiments have been made that indicated a gain in short stroke engines, on account of less cylinder condensation; but it is probable that only the most careful experiments, following great exactness in construction of ports, clearances, and cut-off, would make the gain perceptible in this case.

(27) J. H. R. asks (1) how to change the specific gravity or degrees of density of sulphuric acid. For instance, I have sulphuric acid of 50°, how can I change it to acid of 66°? A. The only practical way to concentrate sulphuric acid is by evaporating off the excess of water over a fire. Vessels of platinum and lead are used to hold the hot acid. Where small quantities of the acid are to be concentrated glass vessels may be employed. 2. Will the same hydrometer do for sulphuric as for nitric or muriatic acid? A. Yes. 3. How is potash crystallized? A. Evaporate the aqueous solution to complete dryness over a water or sand bath; then heat the mass to fusion in a clean iron pan over the fire, cover it securely, and let it cool slowly. 4. Will not wrought iron answer as well as cast iron for field magnets of a dynamo electric machine? A. Yes.

(28) J. T. C. says: 1. I have tried to make the phosphorescent paint noticed in SUPPLEMENT of January 18, 1879, but after repeated trials have had no success, and do not know to what to ascribe my failures. Can you give me any additional particulars? A. See Phosphorescent Substances, page 58, vol. xiv. 2. I have used strontium chloride instead of strontium carbonate.

Will that make any material difference? A. Strontium chloride is not suitable for the purpose; use the carbonate.

(29) A. S. P. writes: Please answer through SCIENTIFIC AMERICAN what is the best method of washing white zinc paint, soap, or borax, or what? A. Use a moderately stiff brush, and a weak hot solution of sal-soda followed immediately by plenty of cold water.

(30) E. E. M. asks: 1. Will you please give me a recipe for making a good indelible ink to be used with a pen? A. Dissolve asphaltum in any essential oil and color with oil printer's ink and a little lamp black. A little benzole will give the ink greater fluidity. 2. Is osmium or any other metal infusible? If not, at what temperature does it fuse? A. Osmium can be fused by means of the oxyhydrogen blow pipe or electric arc, but under such conditions the liquid volatilizes as rapidly as formed, so that it can hardly be said to liquefy. Osmium is the most refractory of metals. The point of liquefaction (or volatilization) has never been accurately determined. 3. What is its specific gravity? A. In the black pulverulent state its specific gravity is about 10; but when heated to the fusing point of rhodium it acquires a density of 21·4—at a still higher temperature it volatilizes. 4. Who was the discoverer of nitrogen and whence its name? A. N (nitrogen) was discovered by Rutherford in 1772. The name was derived from niter, of which it is an essential constituent.

(31) W. F. E. asks: What are the ingredients required to make a good durable waterproof liquid stove polish. I have seen some such polish, and wish to know how it is made. I want a polish that will not burn off and give an offensive smell at the first fire, and should a sample stove be out in a shower the polish ought to resist the action of the water. A. You can try the following: Purified black lead (graphite) reduced to a very fine powder, one pound; per chloride of iron, half an ounce. Moisten with just enough water to form a stiff paste, and mix intimately by trituration in a mortar, and gradually add water sufficient to reduce the paste to a liquid. Shake before using.

(32) W. C. B. asks: Can you furnish me with any process or formula for bleaching and deodorizing dark or off colors of tallow and grease? A. The following treatment is recommended: Briskly agitate the fused grease with about three per cent of sulphuric acid and two per cent of a saturated aqueous solution of bisulphite of soda. Then run the mixture into a deep narrow cylindrical vessel, and agitate the whole violently by dry steam injected in small quantity at the bottom, for half an hour or more. Run off, let cool slowly, and while still fluid draw off the clear portion—without disturbing any sediment. Agitate again by injected steam with about twenty per cent of water and let stand to separate and harden.

(33) E. S. R. asks: What is the preparation used for silver plating spoons and table ware, etc., and where can it be procured? A. See Electro-Silver Deposits, page 81, vol. xliv., and column of Business and Personal.

(34) C. B. asks: Can you tell me where I can find practical information on gilding and electroplating? A. You will find a comprehensive paper on the subject of electroplating and gilding in SCIENTIFIC AMERICAN SUPPLEMENT, No. 310.

(35) W. A. M. asks: How can I print in gold or silver letters on black cotton tape? A. Use printer's gold size with the type (see answer to other correspondent on this subject), and, when partly dry, dust the printed parts with gold bronze.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L. W. D. P.—1. The clay is quite impure, but if burned would probably make good soft brick. 2. Marmolite, with a little calcite—no commercial value. 3. Schistose rock carrying a little copper carbonate.—S. M. C.—They are crystals of quartz—not precious stones but sometimes when very clear and well formed marketable in small lots.—J. R. E.—Syenitic rock bearing red hematite iron ore.

[OFFICIAL.]

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Bags, D. W. Manwaring..... 8,890
Beer, bottled, American Beer and Ale Bottling Company..... 8,827
Bitters, J. E. Ri Dout..... 8,842
Blacksmiths' and machinists' tools, all kinds of, Wiley & Russell Manufacturing Company..... 8,845
Cambrics, R. D. Wood & Sons..... 8,861
Canned goods, certain, J. H. W. Huckins & Co..... 8,836
Clothing, boys', A. Shuman & Co..... 8,844
Cotton goods, A. McLean..... 8,857
Cotton piece goods, Amoskeag Manufacturing Company..... 8,846, 8,847
Cotton piece goods, Langdon Manufacturing Company..... 8,895
Drygoods, fancy, E. Flaxland..... 8,853
Earth working tools, certain, Collins Company..... 8,832
Edge tools, certain, Collins Company..... 8,829 to 8,831
Linen fabrics, G. Riggs..... 8,848
Meats and hams, cured, W. G. Bell & Co..... 8,838
Medical compound for diseases of the skin, W. Mulchahey..... 8,808
Medicinal preparations, R. H. Higgins & Co..... 8,807
Pencils and rubber erasers, G. Schwanhäusser..... 8,858
Pencils and rubber erasers, drawing lead, G. Schwanhäusser..... 8,860
Pencils, drawing lead, G. Schwanhäusser..... 8,859
Pencils, lead, E. Faber..... 8,826
Quicksilver flasks, Quicksilver Mining Company..... 8,841
Razors, knives, and scissors, W. Brokhahne..... 8,848 to 8,851
Saws, H. Disston & Sons..... 8,862 to 8,865
Shirts, collars and cuffs, J. McDonald, Jr..... 8,849
Stationery, E. Faber..... 8,825
Stove, certain kind of, Magee Furnace Company..... 8,839
Studs, shirt, Horton, Angell & Co..... 8,854
Tobacco pouches, India-rubber, G. Coles..... 8,893

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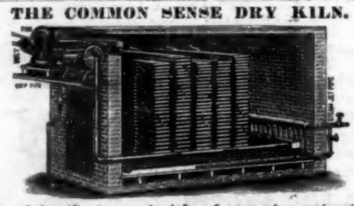

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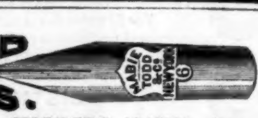

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